DOCUMENT RESUME

ED 167 397 SE 026 781

TITLE	Mathematics Curriculum Guide, Years One to Twelve. 1978 Edition.
INSTITUTION	British Columbia Dept. of Education, Victoria. Curriculum Development Branch.
PUB DATE	78
NOTE	96p.; For related document, see SE 026 780 ; Small print marginally legible
AVAILABLE FROM	Publication Services Branch, Ministry of Education, Parliament Buildings, Victoria, British Columbia, Canada V8V 2Z6 (no price quoted)
EDRS PRICE	MF-$0.83 HC-$4.67 Plus Postage.
DESCRIPTORS	Curriculum; *Curriculum Guides; Elementary Secondary Education; Instruction; *Instructional Materials; *Mathematics Education; *Objectives; *Reference Materials; *Textbooks

ABSTRACT

This curriculum guide states the cognitive goals of the mathematics program in the Province of British Columbia school system. Five major goals are stated as are specific learning outcomes for each grade level. The goals are organized around nine strands: (1) sets and set operation; (2) number and number operations; (3) geometry; (4) measurement; (5) problem solving; (6) graphs and functions; (7) applications of mathematics; (8) logical thinking; and (9) probability and statistics. The appendix contains a textbook list, materials and equipment, and supplementary and reference materials. (MP)

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PROVINCE OF BRITISH COLUMBIA

MINISTRY OF EDUCATION

DIVISION OF PUBLIC INSTRUCTION – SCHOOLS

CURRICULUM DEVELOPMENT BRANCH

MATHEMATICS

Curriculum Guide

Years One To Twelve

VICTORIA, B.C.

1978

Acknowledgement

The Ministry of Education gratefully acknowledges the professional advice and assistance of the following members of the Mathematics Revision Committee.

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Issued by the
Authority of the Lieutenant-
Governor in Council
British Columbia
1978

Further copies available from:
Publication Services Branch
Ministry of Education
Parliament Buildings
Victoria, B.C.
V8V 2Z6

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I. GENERAL STATEMENT

Mathematics in the traditional curriculum consisted largely of computational arithmetic. This aspect of mathematics has played, and will continue to play an important part in the education of our children. Mathematics programs now being prepared focus upon developing in students a freedom to explore, to look at new probelms in the light of past experience and knowledge, and to reach out for novel approaches or solutions.

Before any formal mathematics can be understood there must be a wealth of manipulative experiences through which concepts and relations are understood at an intuitive level. Mathematics as a discipline, as a formal structure, must be built upon a sound foundation of concrete experiences. Formal study of mathematics as a structured discipline is the function of post-elementary education.

The intuitive understanding of mathematical concepts and relations is not sufficient. A child must be able to perform or "do mathematics." At the elementary level it is important the mathematics program include facts, computation and processes.

A mathematics program must teach children to solve problems. Problems start in the physical world and are translated into the language of mathematics for ease of handling. The solutions are given meaning by relating them back to the physical world. Wherever possible, as new topics, concepts or processes are introduced the student should be presented with realistic problems related to the concrete world.

Fundamental to the program in dealing with these problems is the following sequence of activities:

a) manipulative, exploratory activities with real objects;

b) simulative activities with non-representational 3-D materials;

c) simulative activities with pictorial representational materials;

d) simulative activities with pictorial non-representational materials;

e) graphical representation or model building activities;

f) construction of a mathematical model;

g) application of appropriate algorithms or mathematical processes;

h) development of a generalized mathematical model for future use.

As students progress through the program and as topics, concepts and processes reach the upper levels of development, the time devoted to concrete and semi-concrete activities decreases in relation to the time spent in more abstract activities.

It may not be necessary or possible in every case to begin at the concrete level. If the material is of such a nature that first hand experience is impractical or if previous experiences have developed the underlying concepts, then initial activities may be at the semi-concrete or abstract level.

On occasion insight into the structure of the mathematics of the situation may allow certain students to go quickly through or skip altogether some steps in the process.

SEQUENCE OF ACTIVITIES

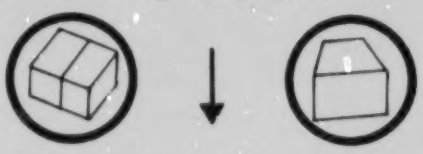
The following is a simple illustration of a sequence of activities.

CONCRETE

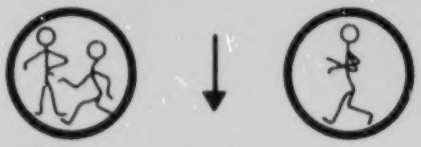
Two people are in a room.
One person comes into the room.
How many people are now in the room?

↓

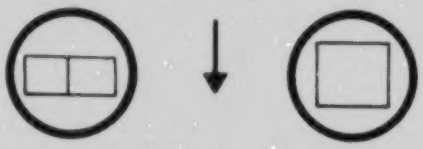
Act out using real people.



Demonstrate using blocks

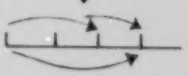


Illustrate using pictures of people.



Illustrate using pictures of blocks.

↓



Construct a graphical model.

$$2 + 1 = n$$

Write the number sentence.

$$\begin{array}{r} 2 \\ +1 \\ \hline 3 \end{array}$$

Solve by addition.

$$a + b =$$

$$a + b = n$$

Write a generalized statement.

ABSTRACT

A problem is perceived.

↓

Real objects are manipulated to arrive at solutions.

↓

Nonrepresentational concrete objects are manipulated to arrive at solutions.

↓

Pictures of real objects are used in arriving at solutions.

↓

Drawings of nonrepresentational objects are used in arriving at solutions.

↓

A graphical model is constructed.

↓

A mathematical model is constructed to represent the structure or the relationship.

↓

Algorithms and mathematical processes are applied.

↓

A generalized mathematical model is developed for future use.

II. NOTES REGARDING IMPLEMENTATION

1. General

The revised program recognizes that there is a body of mathematical knowledge and skills that must be provided for all students. In addition, provision must be made for students with specific requirements. As a consequence, a two part mathematics program has been planned. The first part, essentially the same for all students, includes the elementary program and extends into the secondary. The second part consists of elective courses selected by the student because of

a) post-secondary goals
b) secondary school program requirements
and c) student interest and ability

Provision has also been made through a multiple-text authorization for alternative subprograms for groups of students. These alternatives allow for differences in approach, depth and rate of learning. The extent to which the inherent benefits are achieved, however, depends in large measure on the resourcefulness of the teacher and the organization of the school.

It is strongly emphasized that no single text be regarded as the sole instrument for meeting the objectives of the mathematics program at any particular level. Various combinations of the authorized texts, along with available supplementary materials may be used to ensure an effective program.

If the program is to be relevant to present needs of students while also providing the foundations for future learning, then mathematics should be integrated with the other subjects. A meaningful integration will go far towards achieving a deep and continuing interest in mathematics and an appreciation for its power and usefulness. The nature and the means of integration will be determined at the school level by the specific programs being offered to the students.

2. Course Outlines, Years 9-10, 11-12:

In each of the levels indicated preliminary drafts of the Course Outlines were included in the Curriculum Guide for one year prior to preparing the final draft. Many comments and constructive criticisms were received from individual teachers and/or groups of teachers from throughout the Province. These comments and criticisms were given careful consideration in the preparation of the final prescription.

3. Computing Science 11

No particular textbook has been prescribed for Computing Science 11. Because of the variety of computer hardware being used, and the variations in course emphasis, a single text would not be practical. A list of possible references for Computing Science 11 is stated in the Appendix. Individual schools or Districts should select the text most suitable for the course being offered. The Computing Science 11 text will be purchased through the local District.

4. Statement of Metrication

The Federal Government has committed Canada to the change to the Metric System. This change will take place over a ten year period and is to be completed by 1981. Commencing in September, 1973, all primary pupils began to use the metric system as a standard of measurement. It has been agreed by the council of Ministers of Education, Canada, that all instruction in elementary and secondary schools be predominently metric by 1978. Mathematics for years K-12 will be completely metric by that date.

It is the intent of the Metric Commission to establish the practice of using spaces rather than commas in the writing of larger numbers (e.g. 746 321 988 rather than 746, 321, 988). However, you will find both forms used in present editions of the prescribed texts. **Spaces are not used in computation.**

The following chart is designed to indicate grade levels at which the various aspects of metric measurement could be introduced. These introductory levels have been suggested after careful consideration by the Mathematics Revision Committee.

GRADE LEVEL	DECIMAL SYSTEM	LINEAR MEASURE	AREA	VOLUME AND CAPACITY	MASS	TIME	°TEMP.
1		arbitrary units cm					
2		cm m 100 cm = 1 m		ordering containers by capacity	arbitrary units kg personal mass	h, 1/2 h	
3		km	cm^2 covering 2-D space	cm^3 filling 3-D space ml, litre	kg g balancing	min	C
4	1, 2 place with linear measure	mm 1000 mm = 1 m 1000 m = 1 km	m^2 concrete activities in finding area	m^3 construction to appreciate size	1000 g = 1 kg	24 h clock	
5	+, − of decimals to 3 places	dec. notation sub-multiples eg. 1 mm = 0.001 m etc.	area problems km^2	volume problems solids capacity problems	1 g = 0.001 kg	standard time Canada	
6	all operations with decimal to 3 places rounding off	estimation	estimation ha*	estimation 1 dm^3 = 1 1 m^3 = 1000 l	estimation metric tonne t**	daylight saving time	
7	analysis of total metric system milli — mega with stress upon 3rd powers of 10 milli kilo mega	rate problems km/h			mg	time zones world	

All common Metric Units, multiples and sub-multiples mastered by end of Grade 7.

* 1 hectare = 10 000 m^2 (used for measuring large areas)

** 1 tonne = 1000 kg

goals of mathematics program

III. GOALS

A. General

Stated on the pages following are the cognitive goals generally thought desirable at this time. The learning outcomes listed for each year are prescriptive but are not exhaustive. Teachers are encouraged to formulate learning outcomes for their own situation consistent with those in this guide.

No mention is made here of goals in the affective domain, not because they are less important, but because there is no consensus among educators of what they should be or how they might be achieved. Teachers are encouraged to develop their own specific objectives in this area.

In identifying the major goals of a mathematics program, one must consider that the broad goals of mathematics are derived from the needs of individuals and of society. The practical usefulness of mathematics in our scientific and technological society is increasingly apparent.

With few exceptions, the content of the revised courses in years 1-10 does not differ significantly from the content of previous courses. The emphasis in years 1-10 remains on the operations with natural, whole and rational numbers and the study of their properties. One major exception is an expanded study of geometry. The treatment is largely intuitive though somewhat more formal at the secondary level. Two other exceptions are an introduction to the concept of function and the employment of flow charting.

The courses are organized around 9 "themes" or strands:

I sets and set operation

II number and number operations

III geometry

IV measurement

V problem solving

VI graphs and functions

VII applications of mathematics

VIII logical thinking

IX probability and statistics

The development of a course, however, does not follow a single strand exclusively but must draw on several strands at once.

B. Major Cognitive Goals: The mathematics program will enable the student:

1. to identify and use the basic properties and operations of the real number system;
2. to identify common geometric figures and demonstrate a knowledge of their basic properties;
3. to transform given numerical and algebraic expressions into equivalent expressions;
4. to solve open sentences of various types and degrees of complexity;
5. to apply knowledge of mathematics to familiar physical or environmental situations in order to construct a descriptive mathematical model of the situation or to solve a problem arising from the situation.

C. Student Evaluation

The major purpose of evaluation is to guide students in their learning. Evaluation determines the extent to which the learning outcomes have been achieved. It should serve to improve educational decision making and to redirect learning. In a general guide such as this, it is not possible to indicate the level of competence to be met by each student at a given time. However, data from various tests, interviews, and checklists based on observations of student performance can facilitate better teaching and learning.

Some approaches to evaluation might include:

1. pre-testing to determine student knowledge, skills, and attitudes at the beginning of a unit. This may enable the instructional program to be tailored more closely to the needs of the individual or of the group.

2. continuing or ongoing evaluation enabling students to assess their progress and teachers to diagnose weaknesses and alter methods and materials accordingly.

3. evaluation at the conclusion of a unit enabling the teacher to determine the degree to which outcomes have been achieved and to assess the overall effectiveness of the instructional program.

Students do not learn at the same rate. Consequently, as school organizational patterns permit, a continuous progress program of some kind should be favored. In such a scheme, each teacher must take full responsibility for his/her students by determining their initial level of competence and then helping them progress.

The evaluation program should provide students with concrete information about their progress, enable teachers to plan and redirect programs based on factual information, and provide parents with a clear statement of what students are learning.

mathematics years 1-2 and 3 learning outcomes

Note: ● This symbol indicates the basic mathematical concepts, understandings, skills and knowledge, essential for all students at each level of the mathematics program. Teachers will note that items marked with this symbol incorporate the learning outcomes outlined in the Guide to the Core Curriculum (1977).

LEARNING OUTCOMES

(1) Years 1, 2, and 3

During YEAR ONE the student:

- 1. Compares sets through matching and relates number symbols to real objects.
- 2. Determines if the number of a set is equal or not equal to the number of another set
- 3. Determines cardinal number of a set to 10
- 4. Reads and writes numerals to 10
- 5. Orders numbers on a number line
- 6. Solves addition equations and recognizes that addition is commutative: $a + b = b + a$
- 7. Solves addition and subtraction equations, and recognizes that addition and subtraction are inverse operations:
  $a + b = c$, $c - a = b$, $c - b = a$
- 8. Uses additive identity with numbers to 10: $a + 0 = a$
- 9. Relates multiplication to repeated addition using products to 10
- 10. Divides orally to 10 (Finding equal subsets and sharing).
- 11. Renames numbers to 10
- 12. Uses ordinals to tenth
- 13. Solves simple problems involving addition and subtraction
- 14. Is able to group by tens and ones and relate this to place value
- 15. Reads and writes numerals to 99
- 16. Counts by 1's to 99
- 17. Recognizes and uses symbols $=, \neq, >, <, +, -, \times$, and $\square$
- 18. Recalls with reasonable speed and accuracy the addition, subtraction, and multiplication facts to 10
- 19. Uses fraction ideas in sharing activities with concrete materials.
- 20. Classifies geometric shapes (informal — can, ball, box, etc.)
- 21. Uses terms faces, edges and corners when examining three dimensional objects
- 22. Uses arbitrary units (hand, foot, block,) and the standard unit (centimetre) to measure and compare lengths
- 23. Reads the clock to tell time on the hour
- 24. Uses meaningfully the vocabulary of comparison and position (e.g. larger, most, heavier, in front of, etc.)

During YEAR TWO the student:

- 1. Recognizes and uses symbols from Year One, and also $\div$, $\mathfrak{c}$, and ( )
- 2. Solves addition equations including concepts of commutativity, $a + b = b + a$, and associativity, $(a + b) + c = a + (b + c)$, using sums to 18
- 3. Solves addition and subtraction equations including concept of inverse operations: $a + b = c$, $c - a = b$, $c - b = a$
- 4. Uses additive identity ($a + 0 = a$) with numbers to 20
- 5. Relates multiplication to repeated addition: products to 20
- 6. Solves multiplication and division equations for products to 20, including concept of inverse operations:
  $a \times b = c$, $c \div a = b$, $c \div b = a$

- 7. Solves multiplication equations including concepts of identity, $a \times 1 = a$, and commutativity, $a \times b = b \times a$, with products to 20
- 8. Translates a word problem into mathematical symbols and solves using appropriate operations (addition and subtraction)
- 9. Uses ordinals to twentieth
- 10. Reads and writes numerals to 999
- 11. Understands the place value of numerals to 999
- 12. Uses expanded notation to rename numbers to 999
- 13. Uses the number line for order, skip-counting and operations
- 14. Skip counts by 2's, 5's, and 10's
- 15. Recalls with reasonable speed and accuracy the addition and subtraction facts to 18
- 16. Recalls with reasonable speed and accuracy the multiplication and division facts to 20
- 17. Solves problems involving pennies, nickels, dimes and quarters. Uses ¢ symbol
- 18. Identifies odd and even numbers to 20
- 19. Identifies 1/2, 1/3, 1/4, (unit fractions) of objects and sets
- 20. Solves addition and subtraction examples with 2 or 3 digit numerals without regrouping
- 21. Solves addition and subtraction equations with regrouping (89 + 6, 82 − 7)
- 22. Traces faces of solids and recognizes and names plane figures (circle, square, rectangle, triangle)
- 23. Uses plane shapes in pattern making
- 24. Folds and traces to gain informal experience with symmetry
- 25. Classifies solids according to faces, edges and vertices
- 26. Estimates and measures length in arbitrary units, centimetres, and metres
- 27. Measures capacity in arbitrary units
- 28. Reads the clock and tells time by the hour and half hour
- 29. Measures personal mass in kilograms

During YEAR THREE the student:

- 1. Recognizes and uses necessary symbols from year two, and also $\sqrt{\ }$, $
- 2. Reads and writes numerals to 9999
- 3. Uses expanded notation in renaming numbers to 9999
- 4. Understands the place value of numerals to 9999
- 5. Solves addition and subtraction examples with 2, 3, and 4 digit numerals, with and without regrouping
- 6. Solves multiplication examples including:
  - a) the zero principle: $a \times 0 = 0$
  - b) the identity principle: $a \times 1 = a$
  - c) the commutative principle: $a \times b = b \times a$
  - d) the associative principle: $(a \times b) \times c = a \times (b \times c)$
  - e) the distributive principle: $a \times (b + c) = (a \times b) + (a \times c)$ for products to 50
- 7. Solves division examples with and without remainders using sets and the number line
- 8. Recalls with reasonable speed and accuracy the multiplication and division facts to 50
- 9. Translates a word problem into mathematical symbols and solves using appropriate operations
- 10. Recognizes and uses correctly the following terms: odd, even, product, sum, difference, remainder

11. Identifies unit fractions of objects and sets. Reads and writes equations using these fraction names
12. Multiplies by 10 and 100
13. Is able to round off numbers to nearest 10 or 100
- 14. Constructs simple geometric models of solids and plane shapes
15. Recognizes axis of symmetry from experiences with concrete materials
- 16. Uses graphs as a means of recording
- 17. Estimates and measures length in arbitrary and metric units to kilometres
- 18. Estimates and measures capacity in arbitrary and metric units in ml and litres
- 19. Determines area by covering 2-D spaces with cm^2
- 20. Determines volume by filling 3-D spaces with cm^3
- 21. Determines mass by balancing in kilograms and grams
- 22. Reads the clock to tell time and records in the conventional way (2:45)
- 23. Recognizes the division of units of time into years, months, weeks, days and hours
24. Reads and writes Roman Numerals to 12
25. Skip counts by 2's, 3's, 5's, 10's
- 26. Reads thermometer in °C

mathematics years 4-5 and 6 learning outcomes

Note: ● This symbol indicates the basic mathematical concepts, understandings, skills and knowledge, essential for all students at each level of the mathematics program. Teachers will note that items marked with this symbol incorporate the learning outcomes outlined in the Guide to the Core Curriculum (1977).

LEARNING OUTCOMES

(2) Years 4, 5 and 6

YEAR 4	YEAR 5	YEAR 6	I. NUMBER, NUMERALS & NUMBER OPERATIONS
			The Student Is Able To:
to 100 000	thru millions	thru billions	● 1. Read and write whole numbers in standard notation.
to 100 000	thru millions	thru billions	● 2. Indicate place value of each digit of a numeral in standard notation.
to 100 000	thru millions	thru billions	● 3. Write numbers in expanded notation.
to 12	to 100	to 1000	● 4. Read and write whole numbers in Roman notation.
by 2 s, 3 s, 4 s, 5 s and 10	by 6 s, 7 s, 8 s and 9	*	● 5. Count.
*	*	*	6. Regroup as required for algorithms
			● 7. Identify sets of:
*	*	*	a) whole numbers
*	*	*	b) even whole numbers
*	*	*	c) odd whole numbers
–	*	*	d) prime numbers
1/2, 1/3, 1/4, 2/3, 3/4	*	*	e) equivalent fractions
–	–	*	f) rational numbers
*	*	*	● 8. Recognize and use factors as terms in multiplication.
*	*	*	● 9. Express a number as the product of two or more factors.
–	*	*	● 10. Express a number as a product of its prime factors.
–	–	*	● 11. Determine the highest common factor of two or more numbers.
*	*	*	● 12. Recognize products as answers in multiplication.
*	*	*	● 13. Recognize products as multiples of a given whole number.
–	–	*	14. Determine the LCM of two or more numbers.
*	*	*	● 15. Use the concepts of a fractional number as:
			a) part of a whole
			b) part of a group

* Is introduced or is being continued.

– Has not been introduced to this level or is discontinued.

YEAR 4	YEAR 5	YEAR 6	NUMBER, NUMERALS & NUMBER OPERATIONS (Cont'd)
			16. Use the terms listed below in discussion and explanation of fractional processes.
*	*	*	a) numerator
*	*	*	b) denominator
*	*	*	c) like fractions
–	*	*	d) unlike fractions
–	*	*	e) proper fractions
–	*	*	f) improper fractions
–	*	*	g) mixed numbers
–	*	*	h) lowest terms
to 100ths	to 1000ths	to 10 000ths	• 17. Write decimal numerals for numbers.
*	*	*	• 18. Use the properties of associativity and commutativity as applied to addition and multiplication. (no emphasis on terminology)
			• 19. Use the addition algorithm to solve examples in:
*	*	*	a) addition of whole numbers
			b) addition of common fractions
*	*	*	i. like fractions
–	*	*	ii. unlike fractions
–	*	*	c) addition of mixed numbers
$	to 1000ths	to 10 000ths	d) addition of decimal fractions
*	*	*	e) column addition
*	*	*	• 20. Use the property of distributivity of multiplication over addition. (no emphasis on terminology)
*	*	*	• 21. Correctly indicate the products — basic facts to 81.
			• 22. Use the multiplication algorithm to solve examples in:
2-figure multipliers	*	*	a) multiplication of whole numbers
–	*	*	b) multiplication of common fractions
–	–	*	c) multiplication of mixed numbers
$ With whole number multipliers	dec. to 1000th × whole no.	all	d) multiplication of decimal fractions
			• 23. Explain multiplication in terms of:
*	*	*	a) repeated addition
*	*	*	b) arrays
*	*	*	c) intersections

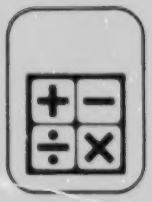
YEAR 4	YEAR 5	YEAR 6	NUMBER, NUMERALS & NUMBER OPERATIONS (Cont'd)
			● 24. Explain subtraction in terms of:
*	*	*	a) separation of sets
*	*	*	b) inverse of addition
			● 25. Use the subtraction algorithm to solve examples in:
*	*	*	a) subtraction of whole numbers involving regrouping
			b) subtraction of common fractions
*	*	*	i. like fractions
–	*	*	ii. unlike fractions
–	*	*	c) subtraction of mixed numbers involving regrouping
$	to 100ths	to 10 000ths	d) subtraction of decimal fractions
*	*	*	● 26. Correctly indicate quotients — basic facts to 81.
			● 27. Explain division in terms of:
*	*	*	a) repeated subtraction of groups of equal size
*	*	*	b) the inverse of multiplication
1-figure divisors	–	–	28A. Use repeated subtraction to solve examples in division of whole numbers.
–	*rem. as fractions	*	● 28B. Use the traditional division algorithm to solve examples in division of whole numbers.
–	–	*	● 29. Solve examples involving division of common fractions and mixed numbers.
whole ⌐$ number	whole ⌐$ number	all	● 30. Solve examples involving division of decimal fractions.
–	*	*	● 31. Compare the number of elements in 2 sets as a ratio.
–	–	*	● 32. Express 2 equivalent ratios in the form of a proportion. Express 2 equivalent rates in the form of a proportion.
			● 33. Express scores or other data:
–	*	*	a) as a ratio
–	*	*	b) as an equivalent ratio with 100 as the second term
–	–	*	c) as a percent fraction

YEAR 4	YEAR 5	YEAR 6	II. SETS AND SET OPERATIONS
*	*	*	34. Use the term "set" in describing and classifying groups of objects and numbers.
			III. GEOMETRY
*	*	*	● 35. Identify and list properties of common 3-D geometrical forms: cube, prism, cylinder, cone, tetrahedron, pyramid, sphere.
*	*	*	36. Construct common 3-D geometrical forms from nets (excluding sphere)
			● 37. Identify and list properties of common 2-D geometrical shapes.
*	*	*	a) triangle
*	*	*	b) rectangle
*	*	*	c) square
–	–	*	d) quadrilateral
–	–	*	e) parallelogram
–	–	*	f) trapezoid
–	–	*	g) pentagon
–	–	*	h) hexagon
–	–	*	i) octagon
centre circumference	diameter	radius chord	● 38. Identify the circle and its parts.
			39. Give examples from the physical world which approximate:
*	*	*	a) the point
*	*	*	b) the line
*	*	*	c) the plane
			● 40. Use the vocabulary of lines.
*	*	*	a) intersecting lines
–	*	*	b) parallel lines
–	*	*	c) perpendicular lines and right angles
–	*	*	d) horizontal and vertical
*	*	*	41. Perform experiments involving translations, reflections, rotations and flips.

YEAR 4	YEAR 5	YEAR 6	GEOMETRY (Continued)
*	*	*	42. Perform investigations and arrive at conclusions related to tiling (tessellations).
*	*	*	43. Discuss symmetry, with respect to axes and points.
			IV. MEASUREMENT
mm cm m km	*	*	• 44. Use instruments to measure the following (arbitrary, metric) a) length
cm^2 m^2	km^2	ha	b) surface
cm^3 m^3	*	dm^3	c) volume
l ml	*	*	d) capacity
g kg	*	tonne	e) mass
to 100ths	to 1000ths	*	• 45. Use decimal notation with metric measures.
24 h clock sec, min, h, d, wk, mo, yr	Standard time	Daylight time century	• 46. Use apropriate units to measure a) time
Celsius	*	*	b) temperature
*	*	*	• 47. Estimate and measure distances, areas, volumes, capacities, masses, using the units specified for the grade.
*	*	*	48. Round off measures to the nearest unit.

YEAR 4	YEAR 5	YEAR 6	V. PROBLEM SOLVING
*	*	*	● 49. Analyze and write open sentences for situation problems and word problems.
*	*	*	● 50. Construct models or diagrams to aid in problem solution.
*	*	*	● 51. Estimate answers and check for appropriateness of answers obtained.
*	*	*	52. Re-state problems in his own words.
*	*	*	53. Construct word problems arising out of investigations.
*	*	*	● 54. Use alternate methods of problem solution.
–	–	*	● 55. Express appropriate problem as an open sentence in the form of a proportion (two equal ratios) and solve.
			VI. GRAPHS
*	*	*	● 56. Interpret:
*	*	*	a) concrete graphs
*	*	*	b) pictographs
*	*	*	c) bar graphs
			d) line graphs
			e) circle graphs
*	*	*	● 57. Construct:
*	*	*	a) concrete graphs
–	–	*	b) pictographs
–	–	*	c) bar graphs
			d) line graphs
–	–	*	58. Make simple scale drawings of rectangular regions.

mathematics years 7 and 8 learning outcomes



Note: ● This symbol indicates the basic mathematical concepts, understandings, skills and knowledge, essential for all students at each level of the mathematics program. Teachers will note that items marked with this symbol incorporate the learning outcomes outlined in the Guide to the Core Curriculum (1977).

LEARNING OUTCOMES

(3) Years 7 and 8

I. SETS AND SET OPERATIONS

7	8		
			The student is able to:
			1. use the following symbols
x	x	●	a) {a, b, c, . . .}
–	x		b) $\in$ ϕ $\subset$ $\cap$ $\cup$
x	x		2. state or demonstrate whether two sets are in one-to-one correspondence;
x	x		3. specify the elements of a set when given a word description of the set;
x	x		4. specify, draw, or state a) the union of two or more sets b) the intersection of two or more sets.

II. NUMBER AND NUMBER OPERATIONS

A. Notation

			The student is able to:
x	x	●	1. distinguish between the concepts of number and numeral;
x	x	●	2. state the value represented by each digit in a multi-digit decimal numeral;
x	x	●	3. write decimal numerals in expanded form using a) powers of ten b) powers of ten in exponent form;
x	x	●	4. use the common mathematical symbols;
–	x		5. write decimal numerals in scientific notation.

B. Number

			The student is able to:
		●	1. identify the elements belonging to the following sets of numbers:
x	x		a) natural or counting numbers
x	x		b) whole numbers
x	x		c) rational numbers
–	x		d) integers
–	x		e) irrational numbers
–	x		f) real numbers
–	x		2. describe the relationship between the sets of numbers listed above in terms of union and intersection;
x	x	●	3. list the factors of a number;
x	x	●	4. list the multiples of a number;
x	x		5. identify the elements belonging to specified sets of numbers: (e.g. prime numbers, even numbers, odd numbers, etc.).

x Is introduced or is being continued.

– Has not been introduced to this level or is discontinued.

C. Operations

7	8			
				The student is able to:
		●	1.	perform the operations of addition, subtraction, multiplication and division with:
x	x			a) whole numbers
x	x			b) rational numbers in
				i. fraction form
				ii. decimal form
				iii. mixed numeral form
–	x			c) integers;
x	x	●	2.	round a decimal numeral to a specified place value;
x	x	●	3.	perform sight multiplication and division with powers of ten;
x	x		4.	write a whole number as a product of its prime factors;
x	x		5.	calculate the G.C.F. of two or more whole numbers;
x	x		6.	calculate the L.C.M. of two or more whole numbers;
x	x	●	7.	write sets of equivalent fractions;
x	x		8.	write an improper fraction for a mixed numeral and conversely;
x	x	●	9.	write a decimal numeral for a fraction numeral;
x	x	●	10.	write a fraction numeral for a decimal numeral;
x	x	●	11.	write a percent numeral for a fraction numeral or a decimal numeral;
–	x	●	12.	use a table to find the approximate square root of a number;
x	x	●	13.	perform, in conventional order, a calculation involving a series of operations;
x	x	●	14.	solve simple open sentences.

D. Principles

The student is able to:

		1.	recognize and use the following principles:
x	x		a) commutative for addition and multiplication
x	x		b) associative for addition and multiplication
x	x		c) distributive
x	x		d) addition of zero
x	x		e) multiplication by one
x	x		f) reciprocals (e.g. $x \cdot \frac{1}{x} = 1 \rightarrow 3 \cdot \frac{1}{3} = 1$)
–	x		g) opposites (e.g. $x + -x = 0 \rightarrow 5 + -5 = 0$)
–	x		h) subtraction (e.g. $x - y = x + -y \rightarrow 7 - 13 = 7 + -13$).

III. GEOMETRY

7	8		
			The student is able to:
		● 1.	describe or give the meaning for the concept of congruency for:
x	x		a) segments
x	x		b) angles
–	x		c) triangles;
		● 2.	use compass and straight-edge to:
x	x		a) copy an angle
x	x		b) bisect an angle
x	x		c) bisect a segment
–	x		d) construct a perpendicular to a line at a point on a line
–	x		e) construct a perpendicular to a line from a point not on the line
–	x		f) construct a parallel to a line through a given point
–	x		g) copy a triangle or construct a triangle to specifications;
		● 3.	identify from a diagram, or draw a diagram illustrating:
–	x		a) adjacent angles
–	x		b) complementary angles
–	x		c) supplementary angles
–	x		d) vertical angles
x	x		e) obtuse angles
x	x		f) right angles
x	x		g) acute angles
–	x		h) isosceles triangles
–	x		i) equilateral triangles
–	x		j) scalene triangles
x	x		k) right triangles
x	x		l) parallel lines
–	x		m) altitudes of triangles
x	x		n) quadrilaterals
x	x		i) parallelograms
x	x		ii) rectangles
x	x		iii) squares
x	x		q) parts of a circle;
–	x	● 4.	calculate the measure of an angle of a triangle given the measures of the other two angles;
–	x	● 5.	use the Pythagorean Theorem to calculate any side of right triangles.

7	8		
			IV. MEASUREMENT
			The student is able to:
x	x	● 1.	describe the steps involved in the measurement process: namely a) choosing a unit b) dividing the object to be measured into the specific units c) counting the number of units used;
x	x	● 2.	use a ruler to measure length in metric units;
x	x	● 3.	use a protractor to measure angles;
x	x	● 4.	state and use the metric units of a) length b) angular measure (degrees) c) area d) volume;
x	x	● 5.	perform the basic arithmetic operations using units of measure.
			V. PROBLEM SOLVING
			The student is able to:
x	x	● 1.	analyze a verbal problem and a) distinguish between what is given and what is to be found b) recognize whether sufficient information is given to solve the problem c) determine what operations are required to solve the problem;
x	x	● 2.	construct a "model" such as a diagram as an aid to solving a problem;
x	x	● 3.	translate verbal problems into open sentences;
x	x	4.	construct a flow chart to fit a verbal description of an operation or procedure;
x	x	● 5.	test the appropriateness of an answer to a problem.
			VI. GRAPHS AND FUNCTIONS
			The student is able to:
x	x	1.	calculate the output number when given input numbers and a function rule;
		● 2.	graph on a number line:
x	x		a) whole numbers
x	x		b) integers

7	8	
x	x	c) rational numbers in i) fraction form ii) decimal form
x	x	3. graph the solution set of an open sentence on the number line

VII. APPLICATIONS OF MATHEMATICS

The student is able to:

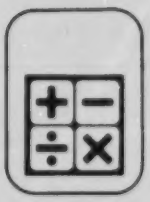
x	x	● 1. draw and interpret scale diagrams;
x	x	● 2. solve problems involving percent, (e.g. interest, discount, sales tax, etc.);
		3. calculate perimeters and areas of:
x	x	● a) rectangles
x	x	● b) triangles
–	x	● c) circles
–	x	d) parallelograms
–	x	e) other polygons;
		● 4. calculate volumes of:
x	x	a) rectangular prisms
–	x	b) cylinders.

VIII. LOGICAL THINKING

The student is able to:

–	x	1. solve open sentences involving the connectives "and" and "or".

mathematics years 9 and 10 learning outcomes



Note: ● This symbol indicates the basic mathematical concepts, understandings, skills and knowledge, essential for all students at each level of the mathematics program. Teachers will note that items marked with this symbol incorporate the learning outcomes outlined in the Guide to the Core Curriculum (1977).

EXPLANATORY NOTES

(4) Mathematics 9 and 10

The content of Years 9 and 10 is an extension of the program undertaken to the end of Year 8 and continues to be based on the premise that a broad mathematical education is necessary for every person in order that he/she be able to understand the world of today and of the future.

The structure of the program in Years 9 and 10 also continues the pattern developed in earlier years in that each course has specified learning outcomes and a multiple text authorization. As well as allowing for differences in approach, depth and rate of learning, this structure provides students with the opportunity to gain experience in how mathematics may be applied to a variety of career and consumer related areas. In addition, provision is made for able and interested students to prepare for further studies in algebra.

ORGANIZATION

It will be obvious that many of the learning outcomes listed below will have been encountered previously by many students and that additional objectives will be necessary for certain other students. It bears repeating, therefore, that the learning outcomes listed are intended as a guide and must be amended by the teacher to meet particular circumstances.

To assist teachers in developing programs appropriate to the students' interests and abilities, the learning outcomes have been categorized as follows:

X This symbol indicates the learning outcomes considered to be the minimum requirements for students preparing for further study in algebra.

In general most students will be expected to study those sections marked with the symbol "X", covering studies in algebra, geometry, and consumer mathematics. It must be emphasized, however, that this material may be studied at varying levels of sophistication and must be adapted by the teacher to suit the interests and abilities of the students.

For those students not planning to enroll in Algebra 11 some modification of this program would be necessary and desirable. For example, less emphasis will be placed on many of the algebra objectives. Some may be omitted. The level of sophistication would be kept appropriate to that required for further studies in Consumer Mathematics 11 or for Industrial and Trades Mathematics 11. Conversely, greater emphasis might be placed on the outcomes dealing with arithmetic operations and measurement.

R This symbol has been used to indicate those items that require review of material covered in previous courses.

E This symbol has been used to indicate areas of enrichment for able and interested students. Enrichment may consist of either exploration of a topic beyond the basic level for the average interested student, or a more intensive exploration of a topic by more capable students who will likely be continuing in a mathematics or science speciality.

In addition to the areas of enrichment described above a number of optional topics have been listed to provide students with the opportunity to explore other areas of interest in mathematics; e.g. Industrial and Trade Mathematics, Probability, Statistics, Computing Science.

CALCULATORS IN SCHOOL

Any student who is unable to perform arithmetic calculations and algebraic operations with accuracy and reasonable speed, is severely handicapped in the study and application of mathematics. The prevalence of inexpensive pocket calculators makes the performance of complicated calculations less tedious, but the use of calculators does not lessen the need for students to understand which concepts and operations are needed to solve a problem, to make sensible estimates, and to analyze their results.

It is recommended that computers and hand calculators be used in imaginative ways to reinforce learning and to motivate the students as proficiency in mathematics is gained. Calculators should be used to supplement rather than to supplant the study of necessary computational skills.

LEARNING OUTCOMES

1. Algebra

R	9	10		
				A. NUMBER AND NUMBER OPERATIONS
				The student is able to:
R	X	X	●	1. perform with increasing accuracy the basic operations of arithmetic with the rational numbers;
R	X	X	●	2. round-off a decimal number to a specified place value;
R	X	X	●	3. change a decimal numeral to a percent and conversely;
R	X	X	●	4. change a fractional numeral to a percent and conversely;
R	X	X	●	5. change a decimal numeral to a fractional equivalent and conversely;
	–	E		6. distinguish between rational and irrational numbers by their decimal forms;
R	X	X		7. convert numerals written in usual notation to scientific notation and conversely;
	E	X		8. calculate products and quotients using scientific notation;
R	X	X	●	9. use the axioms of the real numbers (commutative, associative, distributive, etc.) to simplify an expression or to solve an open sentence;
	E	E	●	10. identify the axioms of the real numbers as illustrated by given statements;
R	X	X		11. write a given positive integer as the product of its prime factors;
	–	E		12. round-off a numeral to a specified accuracy in terms of significant digits.
				B. POLYNOMIAL EXPRESSIONS
				The student is able to:
	X	X		1. use the laws of exponents in simplifying expressions with integral exponents;
	X	X	●	2. evaluate an algebraic expression or formula for given values for the variables;
	X	X		3. add and multiply polynomials and apply these operations to: a) simplifying expressions b) solving open sentences;

X Is introduced or is being continued.
– Has not been introduced to this level or is discontinued;

R	9	10		
	X	X		4. divide a given polynomial by a monomial;
	E	E		5. divide a given polynomial by a (linear) binomial;
	X	X		6. find the greatest common factor of two or more monomials;
	X	X		7. given a monomial and one of its factors, find the other factor;
	X	X		8. given a polynomial containing a common monomial factor, write the polynomial in factored form;
	–	E		9. factor certain polynomials by grouping terms;
	E	X		10. given a binomial that is the difference of two squares, write it in factored form;
	E	X		11. write the square of any binomial as a trinomial;
	E	X		12. write (at sight) the terms in the product of two binomials;
	E	X		13. factor a quadratic trinomial;
	E	E		14. factor a given polynomial product by combining several types of factoring.

C. SOLUTION OF OPEN SENTENCES

The student is able to:

				1. solve open sentences:
R	X	X	●	a) simple equations
	E	X	●	b) simple inequalities
				c) quadratic equations
	–	E		i) by formula
	–	E		ii) by factoring
				d) systems of linear equations
	–	E		i) by graphing
	–	E		ii) algebraically
	–	E		e) linear inequalities by graphing on the number line
	–	E		f) radical equations;
	E	E		2. given an equation containing two or more variables, solve the equation for one of the variables in terms of the others;
	E	E		3. perform the operations of union and intersection in the graphing of, or the finding of, the solution sets of compound open sentences.

R	9	10			
					D. PROBLEM SOLVING
					The student is able to:
R	X	X	●	1.	translate an English phrase or sentence into an algebraic expression or open sentence;
	X	X	●	2.	solve word or "story" problems algebraically (including ratio and proportion).
					E. GRAPHING RELATIONS
					The student is able to:
	X	X	●	1.	given a table or a list of ordered number pairs, plot a graph;
	X	X	●	2.	given an equation in two variables, graph the equation in the coordinate plane;
	–	E		3.	given the graph of a relation, or its open sentence, indicate the domain and range of the relation and determine whether the relation is a function;
	–	E		4.	given a linear inequality, construct its graph.
					F. RADICAL EXPRESSIONS
					The student is able to:
	X	X	●	1.	find the square root of perfect squares of numbers and monomials by factoring;
	X	X	●	2.	use a table to find the square and square root of a number;
	–	E		3.	write square root radical expressions in simplest form.

2. Geometry

R	9	10		

A. PARALLEL LINE

The student is able to:

	X	X	●	1. determine from a given diagram whether two or more lines cut by a transversal are parallel using one of the following properties: a) corresponding angles b) alternate angles c) sum of the interior angles;
	X	X	●	2. determine from a given diagram the measure of specified angles when the diagram embodies parallel lines cut by a transversal.

B. PYTHAGOREAN THEOREM

The student is able to:

				1. calculate one side of a right-angled triangle given the other two, the result being expressed in:
R	X	X	●	a) numerical form
	–	E		b) simplest radical form;
	–	E		2. state and use as required the ratio of the sides of the: a) $30^\circ - 60^\circ - 90^\circ$ triangle b) $45^\circ - 45^\circ - 90^\circ$ triangle.

C. CIRCLE

The student is able to:

R	X	X	●	1. identify from a diagram or draw a diagram illustrating the parts of a circle; centre, chord, diameter, radius, central angle, sector, segment;
	–	X		2. determine from a given diagram the measures of specified segments, arcs or angles using one or more of the following properties: a) the centre of a circle lies on the perpendicular bisector of a chord b) a tangent is perpendicular to a radius at its point of contact c) two tangents to a circle from an external point are equal and make equal angles with the line joining that point to the centre d) inscribed angles of a circle subtended by the same chord are equal e) inscribed angles of a semi-circle are right angles f) the central angle of a circle is twice the inscribed angle subtended by the same arc;

R	9	10			
	E	X	●	3.	makes the following constructions: a) locate the centre of a given circle b) draw a tangent to a given circle from a point outside the circle c) circumscribe a circle about a triangle d) inscribe a circle in a triangle

D. SIMILAR FIGURES

The student is able to:

	E	X	●	1.	determine whether two triangles are similar;
	E	X	●	2.	calculate a side of one of two similar triangles;
	–	E		3.	specify the sine, cosine and tangent of an acute angle as the ratio of two sides of a right triangle;
	–	E		4.	determine the trigonometric values of 30°, 45°, 60° by applying the definitions of sine, cosine, and tangent and the Pythagorean Theorem;
	–	E		5.	use trigonometric tables to find the trigonometric values of an acute angle and conversely;
	–	E		6.	use trigonometry and the Pythagorean Theorem to solve right triangles and problems involving triangles;
R	X	X	●	7.	make and read scale drawings.

E. CONGRUENT FIGURES

The student is able to:

R	X	X	●	1.	determine whether two triangles are congruent using S-A-S, S-S-S and A-S-A properties;
	X	X	●	2.	construct triangles given S-A-S, S-S-S, A-S-A and S-S-A measures;
	E	E		3.	identify congruent triangles in more complex figures.

F. SYMMETRY

The properties of symmetry should be used where helpful.

R	9	10		

G. MEASUREMENT

The student is able to:

R	X	X	●	1. calculate the perimeter of a: a) polygon, given its sides b) circle, given its radius or diameter c) composite figure, given the appropriate measures;
				2. calculate the area of a:
R	X	X	●	a) triangle
R	X	X	●	b) rectangle
	X	X	●	c) parallelogram (given the formula)
	X	X	●	d) trapezoid (given the formula)
R	X	X	●	e) circle
	E	E		f) sector (given the formula)
	E	E		g) composite figure (e.g. regular polygon, ring);
	X	X	●	3. given the formula, calculate the surface area of a: a) rectangular prism b) triangular prism c) cylinder d) cone e) pyramid f) sphere;
			●	4. given the formula, calculate the volume of a:
R	X	X		a) rectangular prism
	X	X		b) triangular prism
R	X	X		c) cylinder
	X	X		d) cone
	X	X		e) pyramid
	X	X		f) sphere;
	X	X	●	5. determine from a given diagram the measure of specified angles when the diagram embodies one or more of the following: a) equilateral triangles b) isosceles triangles c) parallelograms d) right angles (complementary angles) e) straight angles (supplementary angles) f) see 2, A (2) – Parallel Lines.

H. VECTORS

The student is able to:

	–	X	1. distinguish between vector and scalar quantities;
	–	X	2. construct a scaled vector diagram to represent a situation described in words;
	–	X	3. calculate the resultant vector for two given vectors by a scale diagram.

3. Consumer Mathematics

The following topics should be used wherever appropriate to develop the mathematical ideas and applications outlined below in sections A, B and C:

Automobile Ownership
Insurance
Borrowing, saving and investing money
Earning money and payroll
Taxes – income, property, sales.

R 9 10

A. SIMPLE INTEREST

The student is able to:

– X ● 1. use the concept of simple interest in calculations of discount, commission, profit and loss, payroll, insurance premiums, property taxes, etc.;

– X ● 2. determine:
a) from a table, or
b) by counting or calculation the number of days in parts of a year;

– X ● 3. calculate present value and future amount.

B. COMPOUND INTEREST

The student is able to:

– X ● 1. explain the meaning of compound interest;

– X ● 2. calculate the number of interest periods in a given length of time;

– X ● 3. calculate bank interest; (given the formula).

C. ANNUITIES

The student is able to:

– E 1. explain the nature of annuities, (those in which the interest period = payment period) as exemplified in:
a) mortgage payments
b) installment buying
c) charge accounts.

– X ● 2. calculate the true rate of interest in installment payments when given the formula.

OPTIONAL TOPICS

4. Industrial and Trade Mathematics

Topics may be selected from the following:

1. Power and energy
2. Construction
3. Manufacturing
4. Graphic Arts

5. Probability

Simple probability may be introduced if desired.

6. Statistics

The student is able to:

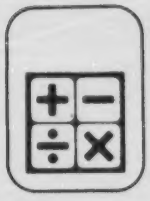
1. organize given data into a frequency distribution;
2. represent given data in graphical form;
3. find for given data:
   a) the mean
   b) the median
   c) the mode;
4. calculate the standard deviation for given data.

7. Computing Science

The student is able to:

1. give a description of the function of each of the major components (input, control, processor, memory, output) of a digital computer;
2. use elementary BASIC as a programming language to write, execute and debug simple programs (where facilities are available);
3. operate "hands-on" a computer system and/or a remote terminal (where facilities are available);
4. construct or read a flow chart for a procedure, algorithm or program.

mathematics years 11 and 12 learning outcomes



EXPLANATORY NOTES

(5) Mathematics: Years 11 and 12

The mathematics courses up to and including Mathematics 10 have been designed on the premise that a broad mathematical education is necessary for everyone. These courses, particularly those at 9 and 10 levels outline mathematical skills, which may be taught at varying levels of sophistication, but which are considered essential for most students. Opportunity is also provided for students to gain experience in how mathematics may be applied to a variety of career and consumer related areas. In addition, provision is made for able and interested students to prepare for further studies in algebra.

At the Year 11 and 12 level, schools, through a selection from the variety of alternative courses available, will be able to provide students with an opportunity to study interest areas in some depth. While these courses deal with particular aspects or applications of mathematics, each has been designed as a resource course. That is, a common set of learnings has been identified for each course and, as well, provision is made for enrichment and for the study of optional interest areas.

The following courses are available: Algebra 11, Algebra 12, Consumer Mathematics 11, Trades Mathematics 11, Computing Science 11, Probability and Statistics 12, and Geometry 12.

ALGEBRA 11 AND ALGEBRA 12

Algebra 11 and Algebra 12 have been designed as a two course sequence for students who have an interest in mathematics and the ability to understand abstract material. They provide students with the opportunity to master the content and techniques of those selected topics in algebra, analytic geometry and trigonometry prerequisite to further study of mathematics. Students who have successfully completed the Algebra 11 and Algebra 12 sequence should be adequately prepared for further studies in mathematics at the post-secondary level. Enrichment topics are provided in each course in order that able students may be challenged.

PREREQUISITES

In preparing these courses, it was assumed that students enrolling for Algebra 11 would have achieved at a satisfactory level in those topics in Mathematics 9 and Mathematics 10 listed as necessary preparation for Algebra 11, (see pages 30-38) and, in particular have demonstrated their mastery of the appropriate algebraic skills. WHILE ALGEBRA 11 HAS BEEN DESIGNED AS AN INTEGRAL PART OF A TWO-COURSE SEQUENCE, IT CAN BE CONSIDERED AS A SELF-CONTAINED COURSE WHICH INTRODUCES THE STUDENT TO TRIGONOMETRY AND ANALYTIC GEOMETRY WHILE CONTINUING TO DEVELOP THE STUDENT'S ALGEBRAIC SKILLS. It is recommended that Algebra 11 be taken prior to (or in special circumstances concurrently with) any mathematics course numbered 12.

Algebra 12 is designed for those students who have achieved at a satisfactory level in the "core" topics in Algebra 11, who have mastered the appropriate algebraic techniques and who have demonstrated that they can understand abstract material.

CORE AND ENRICHMENT

The scope and sequence chart and detailed course outlines for Algebra 11 and Algebra 12 which follow (see pages 44-54 should be viewed in the following context–

1. At the Years 11 and 12 levels there are two prescribed courses in Algebra – Algebra 11 and Algebra 12.

2. Algebra 11 and Algebra 12 have been outlined in both a core and enriched format. The two formats for each course are provided for convenience purposes recognizing that:
   - students will take Algebra 11 and/or Algebra 12 for a variety of interest or career purposes;
   - ability levels of student taking these courses will vary;
   - the more able students should be challenged.

3. In each course outline the enriched format contains all of the topics outlined in the core format and additional topics of interest and challenge. A choice of texts has also been provided to allow for coverage of those topics common to both the core and enriched formats at varying levels of sophistication and to cover the additional topics in the enriched format.

4. A variety of school and/or classroom organizational strategies will be employed in offering these courses–
   - for schools where streaming of class is organizationally feasible and felt advisable, the two formats will provide the basis for the instructional programs;
   - for schools where streaming is not organizationally feasible or not felt advisable, an instructional program that allows for student differences may be ensured through the study of the core format and selected studies of additional topics outlined in the enriched format to the extent that time and the abilities of the students permit.

5. In allowing for differences in approach, depth and rate of learning it is anticipated that teachers will choose texts that treat the topics at a level of sophistication appropriate to the needs and abilities of the students. It should be noted that the exclusive use of any one text may not be appropriate for all topics.

ALGEBRA 11

The Core Format of Algebra 11 is designed to provide a foundation in mathematics for those students who are seeking admission into certain careers and post-secondary institutions and who have neither the need nor the desire to continue with studies in mathematics beyond the secondary level.

The Enriched Format of Algebra 11 is designed to provide students of above average mathematical ability with more challenging material. Although few additional topics are introduced the treatment of all topics in this format should be at a more sophisticated level than that suggested for the core format. Teachers should note that some topics in the enriched format of Algebra 11 also occur in the core format of Algebra 12.

Able students, particularly those who anticipate studying mathematics at post-secondary institutions, should be encouraged to use the more sophisticated material and should, where possible, study the additional topics outlined in the enriched format.

ALGEBRA 12

The Core Format of Algebra 12 is designed for students who intend to enter post-secondary institutions to study in those fields (such as the social sciences) which require some mathematics beyond the grade 12 level.

The Enriched Format of Algebra 12 is designed for those students of above average mathematical ability. The treatment of all topics in the enriched format of Algebra 12 should be considerably more sophisticated than that suggested for the core format. Able students, including those who plan to enrol in first year calculus courses at a post-secondary institution, should be encouraged to use the more sophisticated material and should, where possible, study additional topics outlined in the enriched format.

Mathematics teachers and school counsellors should ensure that students are studying mathematics at the level which best suits their abilities and prepares them for their subsequent careers or studies at post-secondary institutions.

Topics 16-19 outlined as optional topics in the enriched format of Algebra 12 are listed in order of priority. It is anticipated that the more able students will study at least one of these topics.

GEOMETRY

The study of geometry is an integral part of the mathematics program in grades one through twelve. By the completion of grade eight, the student should be able to use compasses, ruler and protractor, to identify and construct many geometrical figures and to know the angle sum and Pythagorean theorems. The student should also be able to calculate perimeters and areas of many common plane figures (for details see page 24).

By the completion of grades nine and ten the student's knowledge of geometry by inductive or discovery methods should have been substantially extended. The student entering Algebra 11 should, therefore, have a thorough foundation in the properties of plane figures including lines, triangles, parallelograms and circles, and should be able to calculate perimeters, areas and volumes of most common geometrical plane figures and solids (for details see pages 33-35). The approach used throughout is largely intuitive and the student will probably have little or no experience with deductive proof.

In Algebra 11 and Algebra 12, teachers should wherever appropriate review and refresh the student's knowledge of geometry. In trigonometry the properties of similar triangles and circles should be reviewed before the introduction of the definition of the trigonometric functions. Triangle congruency should be reviewed and the basic results stressed when solution of triangles with the law of sines and law of cosines is introduced.

In analytic geometry, simple loci – straight line, circle – and their properties should be reviewed. For example, the distance formula $l = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$, provides a direct application of the Pythagorean theorem and may be used to determine the equations of perpendicular bisectors and circles. The concept of slope permits a further review of the properties of parallel lines, perpendicular lines and similar triangles.

The concepts of rotation, translation, symmetry and reflection should be stressed whenever appropriate in the study of functions and their graphs.

Geometry 12 has been developed to provide the student with the opportunity to study the concepts indicated above in greater depth using a more sophisticated approach. In addition, it provides the student with an opportunity to learn the logic and method of proof by deduction.

CALCULATORS IN SCHOOL

Any student who is unable to perform arithmetic calculations and algebraic operations with accuracy and reasonable speed, is severely handicapped in the study and application of mathematics. The prevalence of inexpensive pocket calculators makes the performance of complicated calculations less tedious, but the use of calculators does not lessen the need for students to understand which concepts and operations are needed to solve a problem, to make sensible estimates, and to analyze their results.

It is recommended that computers and hand calculators be used in imaginative ways to reinforce learning and to motivate the students as proficiency in mathematics is gained. Calculators should be used to supplement rather than to supplant the study of necessary computational skills.

SCHOLARSHIP EXAMINATIONS IN MATHEMATICS

Effective in the 1978-79 school year the scholarship examination will be based upon the topics outlined in the Algebra 12 **core format.**

The scholarship student will be expected to perform at a higher level of sophistication than expected for regular coverage of the topics listed for the Algebra 12 core format.

SUGGESTED TIME ALLOTMENTS

In order to allow realistic and ample time allocation the **core formats** for Algebra 11 and Algebra 12 have been developed anticipating that approximately 100 hours of instruction will be available for each of the two courses. This should include sufficient time for consideration of, and selection of, additional enrichment topics.

The **enriched formats** for Algebra 11 and Algebra 12 will normally require 125 hours of instruction for each of the two courses. The manner in which provision is made for the instruction of students studying the enriched formats or anticipating writing the scholarship examination will, necessarily, vary from school to school.

GRADING IN CORE AND ENRICHED FORMATS

If students are to be encouraged to study mathematics at a level best suited to their abilities it is important that appropriate grading procedures be established. In particular, students whose studies are chosen from the enriched formats should not be penalized in the assignment of final grades in Algebra 11 or Algebra 12 for undertaking work of a more challenging nature.

The following legend has been used to denote textbook references contained in the scope and sequence chart and course outlines for Algebra 11 and Algebra 12 that follow on pages 44-54

LEGEND

(UAA)	Using Advanced Algebra (Doubleday)
(MMW 1112)	Mathematics for a Modern World 1112 (Gage)
(PCM)	Pre-Calculus Mathematics (Merrill)
(Dolc)	Dolciani: Modern Algebra and Trigonometry, Book 2 (Nelson)

SCOPE AND SEQUENCE CHART

TOPIC	ALGEBRA 11		ALGEBRA 12		REMARKS
	CORE FORMAT	ENRICHED FORMAT	CORE FORMAT	ENRICHED FORMAT	Note: References to Dolciani are intended to support and supplement the texts.
1. Linear Sentences	MMW 1112, Units 6, 7, 9 or UAA CH. 2, pp. 34-69	UAA CH. 2, pp. 34-69			Topics 1-3 are largely review.
2. Polynomials	MMW 1112, Units 2, 3 or UAA CH. 3, pp. 71-111	UAA CH. 3, pp. 71-111			
3. Rational Expressions	MMW 1112, Units 4.1, 4.2, 8 or UAA CH. 4, pp. 115-150	UAA CH. 4, pp. 115-150			
4. Extending the Number System	MMW 1112, Unit 5 or UAA CH. 5, pp. 151-175	UAA CH. 5, pp. 151-194 Dolc CH. 7, pp. 258-267 Dolc CH. 10, pp. 398-409	UAA CH. 5, pp. 176-194 Dolc CH. 10, pp. 398-409 Dolc CH. 7, pp. 273-279	As in Core	Complex numbers are not in Alg. 11 Core.
5. Systems of Linear Sentences	MMW 1112, Units, 7, 8 or UAA CH. 6, pp. 195-210 and pp. 218-222	UAA CH. 6, pp. 195-222 Dolc CH. 3, pp. 95-107	UAA CH. 6, pp. 210-217 Dolc CH. 3, pp. 95-107	As in Core	Linear Systems in three variables are not in Alg. 11 Core.
6. Relations and Functions	MMW 1112, Units 9, 10 or UAA CH. 7, pp. 224-263 UAA CH. 9, pp. 330-333	UAA CH. 7, pp. 224-263 UAA CH. 9, pp. 330-333 Dolc CH. 8, pp. 297-300 Dolc CH. 6, pp. 211-217 Dolc CH. 3, pp. 90-94			Graphing techniques are not in MMW 1112.
7. Quadratic Relations	MMW 1112, Units 4.3 through 4.6, 13.4 through 13.7 or UAA CH. 8, pp. 269-288 and pp. 292-305	UAA CH. 8, pp. 269-305 UAA CH. 9, pp. 337-339 Dolc CH. 6, pp. 220-238 Dolc CH. 7, pp. 268-285	UAA CH. 8, pp. 289-292 Dolc CH. 7, pp. 273-279 Dolc CH. 10, pp. 407-409	As in Core	Radical equations are not in MMW 1112. The discriminant of the quadratic is not in Alg. 11 Core.
8. Trigonometry	MMW 1112, Units 10.2, 16 through 20.2 or UAA CH. 12, pp. 426-445	UAA CH. 12, pp. 426-457 MMW 1112, Units 10.2 and 16 (optional reference) Dolc CH. 10, pp. 363-398 Dolc CH. 11, pp. 436-448	UAA CH. 12, pp. 426-457 UAA CH. 13, pp. 458-478 Dolc CH. 10, pp. 363-398 Dolc CH. 11, pp. 413-431 and pp. 436-448 Dolc CH. 12, pp. 455-469 and pp. 477-483	PCM CH. 6, pp. 176-193 PCM CH. 5, pp. 125-164 Dolc CH. 10, 11, and 12	Pages 426-445, UAA are review in Alg. 12

SCOPE AND SEQUENCE CHART

TOPIC	ALGEBRA 11		ALGEBRA 12		REMARKS
	CORE FORMAT	ENRICHED FORMAT	CORE FORMAT	ENRICHED FORMAT	Note: References to Dolciani are intended to support and supplement the texts.
9. Conics and Quadratic Systems. The second degree relations			UAA CH. 9, pp. 307-349 Dolc CH. 8, pp. 293-330	UAA CH. 9, pp. 307-349 PCM CH. 9, pp. 273-285	
10. Exponents and logarithms Transcendental Functions			UAA CH. 10, pp. 350-385 Dolc CH. 9, pp. 333-359	PCM CH. 11, pp. 333-357 Dolc CH. 9, pp. 333-359	
11. Graphing Techniques			UAA CH. 7, pp. 251-263	PCM CH. 4, pp. 97-112 and pp. 118-121	UAA CH. 7 is review.
12. Polynomial and Rational Functions			UAA CH. 14, pp. 479-504 Dolc CH. 14, pp. 519-533	PCM CH. 10, pp. 297-332 Dolc CH. 14, pp. 519-538	
13. Sequences and Series			UAA CH. 11, pp. 388-425 Dolc CH. 13, pp. 487-514	As in Core with selected questions from PCM CH. 13	
14. Vectors in the Plane				PCM CH. 7, pp. 197-232	
15. Polar Coordinates				PCM CH. 12, pp. 363-390	
OPTIONAL TOPICS 16. Vectors in 3 Space Solid Analytic Geometry				PCM CH. 8, pp. 241-272 PCM CH. 9, pp. 290-292	

SCOPE AND SEQUENCE CHART

TOPIC	ALGEBRA 11		ALGEBRA 12		REMARKS
	CORE FORMAT	ENRICHED FORMAT	CORE FORMAT	ENRICHED FORMAT	Note: References to Dolciani are intended to support and supplement the texts.
17. Linear Algebra				UAA CH. 16, pp. 534-570 Dolc CH. 15, pp. 543-572	
18. Introduction to Calculus				PCM CH. 14-16, pp. 427-513	
19. Probability and Statistics				UAA CH. 15, pp. 505-533	

ALGEBRA 11 – COURSE OUTLINE

TOPIC	ALGEBRA 11		NOTES
	CORE FORMAT	ENRICHED FORMAT	Note: References to Dolciani in Alg. 11 (enriched) are intended to support and supplement the treatment of topics provided by the texts MMW 1112 and UAA
1. Linear Sentences	Linear equations and inequalities Compound sentences Linear equations and inequalities in two variables Slope intercept form of equation of line MMW 1112, Units 6, 7, 9 or UAA CH. 2, pp. 34-69	As in Core UAA CH. 2, pp. 34-69	1. This topic is largely review.
2. Polynomials	Operations with polynomials: – addition – subtraction – multiplication – division Factoring polynomials MMW 1112, Units 2, 3 or UAA CH. 3, pp. 71-111	As in Core UAA CH. 3 pp. 71-111	1. This topic is largely review.
3. Rational Expressions	Laws of exponents Operations with rational expressions: – addition – subtraction – multiplication – division Equations involving rational expressions Rate-time problems MMW 1112, Units 4.1, 4.2, 8 or UAA CH. 4, pp. 115-150	As in Core (see note 3) UAA CH. 4, pp. 115-150	1. This topic is largely review 2. The acquisition of manipulative skills in Algebra is essential for students intending to proceed further with the study of mathematics. 3. Word problems should be emphasized.
4. Extending the Number System	Roots $\sqrt{\ }$, $\sqrt[3]{\ }$, etc. Rationals and irrationals as decimals Operations with radicals: – addition – subtraction – multiplication – division MMW 1112, Unit 5 or UAA CH. 5, pp. 151-175	Roots $\sqrt{\ }$, $\sqrt[3]{\ }$, etc. Rationals and irrationals as decimals Operations with radicals: – addition – subtraction – multiplication – division Complex numbers (see note) – graphing – absolute value Operations with complex numbers UAA CH. 5, pp. 151-194 Dolc CH. 7, pp. 258-267 Dolc CH. 10, pp. 308-409 (see note 2)	1. Complex numbers are not part of the core of Algebra 11. 2. References to the complex roots and the discriminant of the quadratic equation on pages 407-409 of Dolciani should be taken in topic 7.

ALGEBRA 11 – COURSE OUTLINE

TOPIC	ALGEBRA 11		NOTES
	CORE FORMAT	ENRICHED FORMAT	Note: References to Dolciani in Alg. 11 (enriched) are intended to support and supplement the treatment of topics provided by the texts MMW 1112 and UAA.
5. Systems of Linear Sentences	Solving systems of linear equations – application to problems Graphing systems of linear equations and inequalities MMW 1112, Units 7, 8 or UAA CH. 6, pp. 195-210 and pp. 218-222	Solving systems of linear equations in two and three variables (see note 1) – applications to problems Graphing systems of linear equations and inequalities UAA CH. 6, pp. 195-222 Dolc CH. 3, pp. 95-107	1. Systems in three variables are not part of the core of Algebra 11.
6. Relations and Functions	Describing relations Domain and range of a function (see note 1) Function notation Linear functions (see note 2) Direct and inverse variation (see note 3) Inverse relations and functions Some graphing techniques – translation (see note 4) – dilation – reflection MMW 1112, Units 9, 10 or UAA CH. 7, pp. 223-263 UAA CH. 9, pp. 330-333	Describing relations Domain and range of a function (see note 1) Function notation Linear functions (see note 2) Direct and inverse variation (see note 3) Inverse relations and functions Some graphing techniques – translation (see note 4) – dilation – reflection UAA CH. 7, pp. 223-263 UAA CH. 9, pp. 330-333 Dolc CH. 8, pp. 297-300 Dolc CH. 3, pp. 90-94	1. This topic is treated in Unit 12, MMW 1112. 2. Equations of parallel and perpendicular lines should be added. 3. Inverse variation occurs in UAA CH. 9, pp. 330-333. 4. UAA uses the terms sliding, stretching, flipping. Students should be familiar with the terms translation, dilation, reflection.
7. Quadratic Sentences	Graphing quadratic functions Maximum and minimum Solving quadratic equations – factoring – formula – application to problems Radical equations (see note 1) Quadratic inequalities Linear-quadratic systems (see note 2) MMW 1112, Units 4.3 - 4.6 MMW 1112, Units 13.3 - 13.7 or UAA CH. 8, pp. 269-288 and pp. 292-305	Graphing quadratic functions Maximum and minimum Solving quadratic equations – factoring – formula – applications to problems The discriminant (see note 3) Radical equations Quadratic inequalities Linear-quadratic systems UAA CH. 8, pp. 269-305 UAA CH. 9, pp. 337-339 Dolc CH. 6, pp. 220-238 Dolc CH. 7, pp. 268-285	1. This topic is not in MMW 1112. 2. This topic occurs in UAA CH. 9, pp. 337-339. Either UAA or MMW may be used. 3. The discriminant is not part of the core.

ALGEBRA 11 – COURSE OUTLINE

TOPIC	ALGEBRA 11		NOTES
	CORE FORMAT	ENRICHED FORMAT	Note: References to Dolciani in Alg. 11 (enriched) are intended to support and supplement the treatment of topics provided by the texts MMW 1112 and UAA.
8. Trigonometry	Review of geometry – angles, triangles, circles, parallel lines, similar triangles (see note 1) Angles and their measure The six trigonometric functions Graphs of the sine, cosine and tangent functions Tables of values of trigonometric functions Solving right triangles (see note 2) MMW 1112, Units 10.2 (review similar triangles) MMW 1112, Units 16 - 20.2 or UAA CH. 12, pp. 426-445	Review of geometry – angles, triangles, circles, parallel lines, similar triangles (see note 1) Angles and their measure The six trigonometric functions Graphs of the sine, cosine and tangent functions Tables of values of trigonometric functions Solving right triangles (see note 2) Solving oblique triangles (see note 3) Vectors (see note 3) UAA CH. 12, pp. 426-457 or MMW 1112, Units 10.2 and 16 (optional reference) Dolc CH. 10, pp. 363-398 Dolc CH. 11, pp. 436-448	1. The geometry review in MMW 1112, Units 10.2 and 16 is useful. If time permits, it should be supplemented. 2. Students should be encouraged to use calculators only after they have had practice using tables. 3. These topics are not part of the core.

ALGEBRA 12 – COURSE OUTLINE

TOPIC Note: Numbers refer to the Scope and Sequence Chart	ALGEBRA 12		NOTES Note: References to Dolciani in Alg. 12 are intended to support and supplement the treatment of topics provided by the texts UAA and PCM.
	CORE FORMAT	ENRICHED FORMAT	
4. Extending the Number System (complex numbers)	+, -, x, ÷ of complex numbers $\|a + bi\|$ complex numbers as ordered pairs, graphing UAA CH. 5, pp. 176-194 Dolc CH. 10, pp. 398-409	As in core	1. This topic is in Algebra 11 enriched. 2. The real number system and operations with radicals in UAA CH. 5 may be reviewed and supplemented with questions from Dolc, pp. 258-267.
5. System of Linear Sentences (3 equations in 3 unknowns)	Solution of 3 equations in 3 unknowns UAA CH. 6, pp. 210-217 Dolc CH. 3, pp. 95-107	As in core	1. This topic is in Algebra 11 enriched. 2. Linear equations and their graphs may be reviewed and supplemented with questions from Dolc, pp. 90-94.
7. Quadratic Relations	Discriminant of quadratic Nature of roots UAA CH. 8, pp. 289-292 Dolc CH. 7, pp. 273-279 Dolc CH. 10, pp. 407-409	As in core	1. This topic is in Algebra 11 enriched.
8. Trigonometry	The six trigonometric functions and their graphs (see notes 1, 3) Solution of right triangles (see note 2) Law of sines Law of cosines Solving oblique triangles (see note 4) Vectors (see note 4) Trigonometric identities Sum and difference formulas Even and odd functions Double and half-angle formulas Conditional trigonometric equations Graphs of $y = A \sin (nx + \alpha)$ etc. (see notes 5, 6) UAA CH. 12, pp. 426-457 UAA CH. 13, pp. 458-478 Dolc CH. 10, pp. 363-398 Dolc CH. 11, pp. 413-431 and pp. 436-448 Dolc CH. 12, pp. 455-469 and pp. 477-483	The circular functions (see note 3) Solution of right triangles (see note 2) Law of sines Law of cosines Solving oblique triangles (see note 4) Vectors (see note 4) Trigonometric identities Sum and difference formulas Even and odd functions Double and half-angle formulas Conditional trigonometric equations Graphs of $y = A \sin (nx + \alpha)$ etc. Inverse trigonometric functions Principal values Areas of sectors and segments Trigonometric form of complex numbers De Moivres theorem nth roots of complex numbers PCM CH. 5, pp. 125-164 PCM CH. 6, pp. 176-193 Dolc CH. 10, 11, 12	1. The words "circular function" and the relationship of trigonometric functions and their graphs to the unit circle should be stressed in reviewing the material already taken in Alg. 11 Core. Radian measure should receive more emphasis. 2. Solution of right triangles is in Alg. 11 Core and is reviewed here. The appropriate geometry of similar triangles, Pythagoras' theorem should be reviewed. 3. The graphs of the three basic trigonometric functions are covered in Alg. 11 (core and enriched). The graphs of the three reciprocal functions are added here. The relationship between the circular and trigonometric functions should be made clear. 4. This topic is in Alg. 11 enriched. 5. Good place to review and use translations and dilations. See topic 11, Alg. 12 core. 6. Students should be familiar with the terms amplitude, period and phase shift.

ALGEBRA 12 – COURSE OUTLINE

TOPIC Note: Numbers refer to the Scope and Sequence Chart.	ALGEBRA 12 CORE FORMAT	ALGEBRA 12 ENRICHED FORMAT	NOTES Note: References to Dolciani in Alg. 12 are intended to support and supplement the treatment of topics provided by the texts UAA and PCM.
9. Conics and Quadratic Systems The Second Degree Relations	Distance formula Midpoint formula Equation of circle – standard form – general form Equation of parabola – definition – equation $x^2 = 4py$ etc. Equation of ellipse – definition – equation $\frac{x^2}{a^2}+\frac{y^2}{b^2} = 1$ etc. Equation of hyperbola – definition – equation $\frac{x^2}{a^2}-\frac{y^2}{b^2} = 1$ etc. Standard forms of equations of conics (see notes 1, 2) Completion of square, etc. Inverse variation (see note 4) Quadratic systems – graphing – solving Problems UAA CH. 9, pp. 307-349 Dolc CH. 8, pp. 293-330	Same listing as in core (see notes 3, 5) UAA CH. 9, pp. 307-349 PCM CH. 9, pp. 273-285	1. The idea of translation is covered in Alg. 11 in UAA CH. 7. This should be reviewed. 2. Graphs of quadratics are treated in UAA CH. 8. This should be reviewed. 3. The treatment and language in PCM is more formal than that in UAA. Latus rectum, eccentricity are introduced. 4. Inverse variations is part of topic 6, Alg. 11 (core and enriched formats). It should be reviewed in connection with the hyperbola $xy = K$. 5. In Alg. 12 enriched emphasis should be given to translation of axes and students should be shown, using rotation of axes, that every second degree equation represents a conic. Rotation problems need not be done.
10. Exponentials, Logarithms, Transcendental Functions	Rational and real exponents Exponential functions – graphs Logarithmic functions – graphs – properties of logarithms Common logarithms (see notes 2, 3) – calculations using logarithms – interpolation Exponential and logarithmic equations Problems UAA CH. 10, pp. 350-385 Dolc CH. 9, pp. 333-359	Rational and Real Exponents Exponential and transcendental functions (see note 1) – graphs The number e. Binomial theorem and $e = \lim_{n \to \infty} \left(1 + \frac{1}{n}\right)^n$ (see note 4) Growth and decay Logarithmic functions – graphs – properties of logarithms Natural and common logarithms – calculations Equations involving logarithms and exponentials PCM CH. 11, pp. 333-357 Dolc CH. 9, pp. 333-359	1. PCM defines "transcendental" functions. 2. PCM emphasizes natural logarithms, UAA emphasizes common logarithms. 3. UAA emphasizes calculations using logarithms. The prevalence of calculators makes this emphasis unnecessary. 4. This topic should be postponed until after the Binomial theorem in UAA CH. 11, sec. 8 (topic 13).

ALGEBRA 12 – COURSE OUTLINE

TOPIC Note: Numbers refer to the Scope and Sequence Chart.	ALGEBRA 12		NOTES Note: References to Dolciani in Alg. 12 are intended to support and supplement the treatment of topics provided by the texts UAA and PCM.
	CORE FORMAT	ENRICHED FORMAT	
11. Graphing Techniques	Some graphing techniques (see notes 1, 2) – translation – dilation – reflection UAA CH. 7, pp. 251-263	Graphing techniques (see note 3) – excluded regions – symmetry, odd and even – functions – asymptotes Continuity PCM CH. 4, pp. 97-112 and pp. 118-121	1. This material is review. Teachers are referred to note 4 of topic 6 in Alg. 11 outline. 2. It is expected that teachers will have reviewed and used these techniques in dealing with the graphs of the conics, the trigonometric functions and exponential and logarithmic functions. 3. These techniques could be taken in conjunction with graphing polynomial and rational functions in topic 12.
12. Polynomial and Rational Functions	Polynomial defined Synthetic division Remainder and factor theorems Integral roots Rational roots Fundamental theorem of Algebra Graphs of polynomials Complex roots occur in conjugate pairs Descartes Rule of Sign UAA CH. 14, pp. 479-504 Dolc CH. 14, pp. 519-533	Polynomial function Graphing polynomials Division algorithm $P(x) = D(x) + Q(x) + R(x)$ Remainder theorem Factor theorem Fundamental theorem of Algebra Complex roots occur in conjugate pairs Synthetic division Upper and lower bound of roots Integral roots Rational roots Rational functions PCM CH. 10, pp. 297-332 Dolc CH. 14, pp. 519-538	1. Descartes Rule of Sign is not in UAA.
13. Sequences and Series	Arithmetic sequences and series – nth term – means – sum of n terms Summation notation Applications of arithmetic sequences and series Geometric sequences and series – nth term – means – sum of n terms Infinite geometric series – idea of limit – sum as $n \to \infty$ Applications Binomial theorem (see note 2) – Pascal's triangle – factorial notation – indicated term Fibonacci sequences UAA CH. 11, pp. 388-425 Dolc CH. 13, pp. 487-514	As in the core with some selected questions from PCM CH. 13, pp. 391-405 (see note 1)	1. UAA treatment should be used for both core and enriched topics. 2. e as $\lim_{n \to \infty} \left(1 + \frac{1}{n}\right)^n$ should be discussed in the enriched format.

ALGEBRA 12 – COURSE OUTLINE

TOPIC Note: Numbers refer to the Scope and Sequence Chart.	ALGEBRA 12		NOTES Note: References to Dolciani in Alg. 12 are intended to support and supplement the treatment of topics provided by the texts UAA and PCM.
	CORE FORMAT	ENRICHED FORMAT	
14. Vectors in the Plane		Vector defined – equivalence class operations with vectors $\vec{u} + \vec{v}$ $\vec{u} - \vec{v}$ $c \cdot \vec{v}$ Axioms of vector space (see note 1) Geometric proofs using vectors (see note 2) Vectors as ordered pairs Magnitude of a vector $\|\vec{v}\|$ Vector projection, components Bases, linear combination, linearly dependent Parametric equation of line (see note 3) Scalar product PCM CH. 7, pp. 197-232	1. Students should not be required to memorize the axioms. 2. This provides a good opportunity to review geometry and to introduce the idea of proof. 3. The concept of parametrization is important in further studies.
15. Polar Coordinates		Coordinates of points (see note 1) Polar distance formula (see note 2) Equations of lines and circles (see note 3) Symmetry Classical curves (see note 4) Points of intersection (see note 5) Relations between polar and rectangular coordinates (see note 6) PCM CH. 12, pp. 383-390	1. Non-uniqueness of coordinates should be stressed. 2. This need not be stressed. 3. General equations need not be stressed. 4. Students should plot points on the curves. Calculators may be used to evaluate r. After familiarity has been gained, sketching of curves should be emphasized. 5. Some problems here are very difficult. They should not be emphasized. 6. This topic is important.
OPTIONAL TOPICS The optional topics are not outlined in detail. Teachers should choose material of interest to their students and at a suitable level of difficulty.			
16. Vectors in 3-space. Solid Analytic geometry		(See Notes 1 - 3) PCM CH. 8, pp. 241-272 PCM CH. 9, pp. 290-292	1. This material extends vectors on the plane to 3-space. 2. Students may find visualization difficult. 3. The material in CH. 9 deals with quadric surfaces – extension of the conics into 3-space.

ALGEBRA 12 – COURSE OUTLINE

TOPIC Note: Numbers refer to the Scope and Sequence Chart.	ALGEBRA 12		NOTES Note: References to Dolciani in the Alg. 12 are intended to support and supplement the treatment of topics provided by the texts UAA and PCM.
	CORE FORMAT	ENRICHED FORMAT	
17. Linear Algebra		Matrices and determinants (See note 1, 2) UAA CH. 16, pp. 534-570 Dolc CH. 15, pp. 543-572	1. This material is relatively easy. 2. Applications to geometry should be mentioned.
18. Introduction to Calculus		(See notes 1, 2) PCM CH. 14, pp. 427-513	1. The approach in PCM is abstract and students may find it difficult. 2. Except with very able students, teachers should consider using a more intuitive approach.
19. Probability and Statistics		(See note 1) UAA CH. 15, pp. 505-533	1. UAA provides a good introduction to Probability and Statistics. Teachers should, wherever possible, use an experimental approach with examples chosen from newspapers, games, etc.

BUSINESS AND CONSUMER MATHEMATICS 11 (Cn Ma 11)

This course is designed for students interested in careers in business or commerce, and for students who wish to become knowledgeable consumers. The course can be adapted to meet the differing needs and interests of each of these groups and the subject matter can be treated in such a way that students need only a minimal level of algebraic skills. In schools where there exists a sufficiently high level of interest and/or demand, the topics listed may be developed in more depth.

The topics should be approached through the solution of real problems in measurement, graphing, interest, discount, profit and loss, installment buying, financing, banking, taxation, annuities, simple statistics, probability, investment, insurance, mortgages, budgeting, etc.

Consultation with teachers of business education and home economics is recommended.
Time Allotment: Approximately 100 hours.

Learning Outcomes

The student is able to develop an understanding of:

1. the basic arithmetical computations (addition, subtraction, multiplication, division of whole numbers, fractions, decimals, percentage) with applications to specific business problems.

2. the Mathematics of Retailing and Accounting
   a) ratio, proportion, percent, markup and markdown
   b) discount, commission, depreciation, inflation
   c) taxes – personal
      – property
      – sales

3. the Mathematics of Banking and Finance
   a) simple interest
   b) compound interest
   c) mortgages
   d) credit cards, installment financing
   e) annuities

4. the Mathematics of Investment
   a) stocks and bonds
   b) insurance – life insurance
      – homeowner's insurance
      – automobile insurance
   c) pension, retirement savings plan, etc.

5. the Mathematics of Decision Making
   a) probability as applied to business
   b) statistics as applied to business

6. consumerism
   a) market surveys
   b) budgeting
   c) laws for consumers

INDUSTRIAL AND TRADE MATHEMATICS 11 (TMa 11)

This course is designed for students interested in careers in trades and industry. The course can be adapted to meet the differing needs and interests of students going into a variety of trades, and the subject matter can be widely varied depending upon the career goals of the students. Practical problems in the mathematics of a wide variety of trades can be included and the particular choice of applications remains a school option.

Consultation with teachers of industrial education is recommended.
Time Allotment: Approximately 100 hours.

Learning Outcomes

The student is able to develop an understanding of:

1. fundamentals of basic arithmetic
   a) operations with whole numbers, fractions
   b) measurement
   c) percentages and averages
   d) finance
   e) graphs

2. fundamentals of algebra with applications
   a) use of symbols
   b) equations
   c) ratio and proportion
   d) exponents and radicals
   e) use of formulas

3. geometry and trigonometry with applications
   a) concepts of lines, angles, circles
   b) plane and solid figures
   c) basic geometric constructions
   d) trigonometric functions
   e) applications of trigonometry to right and oblique triangles

4. aids in calculation
   a) slide rule
   b) pocket calculator
   c) use of tables

Optional Units for the following trades are available.
a) Plumbers and pipefitters
b) Automotive technicians
c) Carpenters
d) Electricians
e) Machinists
f) Welders

COMPUTING SCIENCE 11 (CSc 11)

This course is designed for any student who is interested in computers and can be adapted to meet the differing needs and interests of the students. The subject matter can be treated in such a way that students need only a minimal level of algebraic skills. The course can be adapted to available equipment whether it be a mini-computer, a remote terminal, or even daily pick-up of cards for processing. In schools where there exists a sufficiently high level of interest and/or demand, the topics listed can be developed in more depth.

It is generally felt that a first course in Computing Science should be more than just a programming course. The course should include programming experience but it should also provide the student with a good general knowledge of how computers have and will affect society. The course should also introduce the student to the many computer related jobs which do not involve programming and outline the educational requirements of employment opportunities involved.

The major goals of the course and/or courses should be to:

1. Develop an appreciation of the role of computers in our society.
2. Obtain basic understanding of the computer as a machine: its capabilities and limitations.
3. Develop the algorithmic process of thought.
4. Acquire a working knowledge of a programming language.
5. Develop skills enabling the student to use the computer for problem solving.

Course Content

Topics	Minimum and maximum number of hours which should be spent on topic.
a) hardware	1-5
b) assembly and machine language	1-1
c) flow charting	2-5
d) documentation	2-5
e) high level language	
i) basic features	20-30
ii) advanced features	5-5
f) applications	
i) mathematical	
ii) data processing	31-39
iii) other	
g) computers and society	5-10
h) employment opportunities	1-2
i) operating systems	1-3
j) exams	3-3

Learning Outcomes (CSc 11)

The student is able to develop an understanding of, and an ability to perform the required operations for each topic:

Part 1: Fundamental Concepts	**hours min. - max.**
1. basic machine structure and specific I/O devices being used	1-3
2. preparing and running sample program	2-3

3.	a) fundamental language features such as constants, variables, assignment statements, simple output, termination.	3-5
	b) simple applications	2-3
4.	fundamental flowchart concepts	1-1
5.	a) program documentation using comments	1-1
	b) simple applications	2-3
		12-19

Part 2: A little more depth. (As each new feature of the language is introduced, its flowchart representation should be introduced and used and at least one program should be written using that feature.)

1.	Unconditional branching	3-4
2.	Conditional branching	4-6
3.	Simple input	3-5
4.	Documentation - title printing	3-4
		13-19

Part 3: A broader view. (Material on computers and society should be covered concurrently, using one or two periods per week, with the programming topics.)

1.	Library functions	4-6
2.	Loop control (DO, FOR, NEXT, etc.)	6-8
3.	Singly subscripted variables	9-15
4.	Computers and Society	5-10
		24-39

Part 4: Projects and Advanced features. (Employment opportunities done in same way as Computers and Society.)

1.	Assembly and machine language (an overview only)	1-1
2.	Operating system (an overview only)	1-2
3.	Advanced language features	5-5
4.	Writing Programs (Individual student projects)	10-12
5.	Employment opportunities	1-2
6.	Hardware	0-2
		18-24

SENIOR GEOMETRY 12 (GEOM 12)

The development of geometric concepts begins at an early age and the revised curriculum grades 1 - 10 recognizes this by emphasizing an intuitive approach. Secondary school geometry has traditionally been viewed as the study of a single axiomatic system, with topics added at an appropriate level from analytic geometry and vectors. Such a development may place severe restraints on students and frequently is hard to motivate.

This course extends the ideas developed in Grades 1 - 10 and is a blend of topics chosen from Euclidean, coordinate, vector and transformational geometries. Manipulative experiences and applied problems should be emphasized so that the course can be adapted to students of varying ability. Some of the concepts in this suggested outline are difficult and should be introduced only to students of above average ability. Although teachers can select topics which emphasize a particular approach to geometry, the use of a variety of approaches will greatly enrich the subject.
Time Allotment: Approximately 100 hours.

Learning Outcomes

The student is able to develop an understanding of, and an ability to perform the required operations for each topic:

1. Geometry of the real world – two and three dimensions.
2. Angles and their measure.
3. Coordinate geometry – Cartesian coordinates, polar coordinates. Simple loci-circle, straight line.
4. The properties of rectangular figures and solids – a deductive approach.
5. The properties of special triangles – right, equilateral, isosceles.
6. Reflections, rotations and translations – the geometry of motion.
7. Similarity, congruence – properties of circles, regular polygons. Similarity transformations.
8. Deduction and proof. Elementary logic.
9. Areas and volumes of regular figures and solids.
10. Vector geometry – addition, subtraction, algebra of vectors.
11. Composite transformations or mappings. Congruence transformations.

PROBABILITY AND STATISTICS 12 (PS 12)

This course is designed for students interested in the application of mathematics to areas such as probability and statistics. Topics may be chosen from the list below to meet the needs, abilities and interests of various groups of students. For example teachers might emphasize applications to biology, business, social sciences. It is suggested that an experimental approach should be used.
Time Allotment: Approximately 100 hours.

Learning Outcomes

The student is able to develop an understanding of, and an ability to perform the required operations for each topic.

1. Algebra of sets
   - $A \cup B$; $A \cap B$; A'
   - distributive law for sets
   - n(A) – number of elements in a set
   - tree diagrams.

2. Permutations and combinations
   - factorial notation
   - binomial theorem
   - counting problems – combinations, permutations.

3. Elementary probability
   - sample spaces
   - simple examples
   - conditional probability
   - independent events, mutually exclusive events
   - repeated trials (Bernoulli trials)
   - games of chance
   - expected value
   - mathematical and experimental probability.

4. Statistics (a descriptive approach)
   - representation of data by various types of graphs mean, median, mode – calculation and use – grouped and ungrouped data
   - standard deviation
   - "grading on the curve"
   - sampling theory
   - – random samples
   - – variance of samples
   - – small samples
   - – large samples
   - correlation
   - testing hypotheses.

5. Optional topics
   a) Logic
      - $a \wedge b$; $a \vee b$; $a \rightarrow b$; $\sim a$
      - truth tables
      - converse, contrapositive
      - algebra of statements
      - arguments
   b) Review of exponential and logarithmic functions and graphs.
   c) Binomial and normal distributions.

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APPENDIX

(1) Prescribed Textbook List

The textbooks authorized for the various levels of the mathematics program are listed below. Teachers' editions are indicated where applicable. A **Prescribed Textbook List** is published annually by the Curriculum Development Branch and is available from the Publication Services Branch. The scale of issue of authorized texts is indicated in the Prescribed Textbook List.

Primary Grades — I, II, III

Mathematics	I	1. a) Eicholtz, O'Daffer: Investigating School Mathematics (Addison-Wesley) b) Elliott et al.: Project Mathematics (Holt, Rinehart and Winston) c) Dilley et al.: Heath Elementary Mathematics (D.C. Heath) 2. Eicholtz, O'Daffer: Investigating School Mathematics, Teachers' Edition (Addison-Wesley) 3. Elliott et al.: Project Mathematics, Teachers' Edition (Holt, Rinehart and Winston) 4. Dilley et al.: Heath Elementary Mathematics, Teachers' Edition (D.C. Heath) 5. Huff, Irwin: Activities in Geometry (Addison-Wesley)
	II	1. a) Eicholtz, O'Daffer: Investigating School Mathematics (Addison-Wesley) b) Elliott et al.: Project Mathematics (Holt, Rinehart and Winston) c) Dilley et al.: Heath Elementary Mathematics (D.C. Heath) 2. Eicholtz, O'Daffer: Investigating School Mathematics, Teachers' Edition (Addison-Wesley) 3. Elliott et al.: Project Mathematics, Teachers' Edition (Holt, Rinehart and Winston) 4. Dilley et al.: Heath Elementary Mathematics, Teachers' Edition (D.C. Heath) 5. Huff, Irwin: Activities in Geometry (Addison-Wesley)
	III	1. a) Eicholtz, O'Daffer: Investigating School Mathematics (Addison-Wesley) b) Elliott et al.: Project Mathematics (Holt, Rinehart and Winston) c) Dilley et al.: Heath Elementary Mathematics (D.C. Heath) 2. Huff, Irwin: Activities in Geometry (Addison-Wesley)

Intermediate Grades — IV, V, VI, VII

Mathematics	IV	a) Dilley et al.: Heath Elementary Mathematics — 4 (D.C. Heath)[1] b) Eicholtz et al.: Investigating School Mathematics — 4 (Addison-Wesley)[1]

		c) Elliott et al.: Project Mathematics – 4 (Holt, Rinehart and Winston)[1]
	V	a) Dilley et al.: Heath Elementary Mathematics – 5 (D.C. Health)[1] b) Eicholtz et al.: Investigating School Mathematics – 5 (Addison-Wesley)[1] c) Elliott et al.: Project Mathematics – 5 (Holt, Rinehart and Winston)[1]
	VI	a) Dilley et al.: Health Elementary Mathematics – 6 (D.C. Health)[1] b) Eicholtz et al.: Investigating School Mathematics – 6 (Addison-Wesley)[1] c) Elliott et al.: Project Mathematics – 6 (Holt, Rinehart and Winston)[1]
	VII	a) Eicholtz, et al.: School Mathematics I, Metric Edition (Addison-Wesley)[1] b) Sobel, Maletsky: Mathematics 1, Metric Edition (Ginn)[1] c) Sobel, Maletsky: Essentials of Mathematics, Metric Edition (Ginn)[1]
		Secondary Grades – VIII TO XII
Mathematics	VIII	a) Eicholtz, et al.: School Mathematics II (Addison-Wesley)[1] b) Sobel, Maletsky: Mathematics II (Ginn) c) Sobel, Maletsky: Essential of Mathematics II (Ginn)
	IX, X	a) Newton, et al.: Mathematics for a Modern World, Book 1 (Gage) b) Newton, et al.: Mathematics for a Modern World Book 2 (Gage) c) Sobel, Maletsky: Essentials of Mathematics 3 (Ginn) d) Dolciani: Modern Algebra, Book 1 – Modules 1, 2, 3 (Houghton Mifflin) – Ma 9 e) Dolciani, Modern Algebra, Book 1 – Modules 4, 5, 6 (Houghton Mifflin) – Ma 10 f) Wigle, et al.: Mathematical Pursuits One (Macmillan) g) Bernstein, Wells: Trouble-shooting Mathematics Skills (Holt, Rinehart and Winston) h) Wigle, et al.: Mathematical Pursuits Two (Macmillan) i) Conchie: Business and Consumer Mathematics (Addison-Wesley) j) Lyng, et al.: Career Mathematics, Industry and Trade (Houghton-Mifflin)

[1] Teachers' Manual available by purchase from the Publication Services Branch.

Algebra 11	XI	a) Del Grande, et al.: Mathematics for a Modern World 1112 (Gage) b) Travers: Using Advanced Algebra (Doubleday) c) Dolciani: Modern Algebra and Trigonometry, Book 2 (Nelson)
Consumer Mathematics 11	XI	1. Bello: Contemporary Business Mathematics – Canadian Metric Edition (W.B. Saunders) 2. Conchie: Business and Consumer Mathematics (Addison-Wesley)
Computing Science 11	XI	See note page 3 of this Guide.

Trades Mathematics 11	XI	1. Olivio: Basic Mathematics Simplified – Canadian Metric Edition (Van Nostrand Reinhold)
		2. (Any or all of the 6 Modules in the following series may be selected providing the total number of modules ordered does not exceed one A issue):
	–	Practical Problems in Mathematics Series (Van Nostrand Reinhold) (Modules: Welders; Auto Technicians; Carpenters; Electricians; Machinists; Plumbers and Pipefitters).
	–	Instructor's Guides for the Modules listed may be purchased from the Publication Services Branch.
Algebra 12	XII	a) Del Grande, et al.: Mathematics For a Modern World 1112 (Gage) b) Travers: Using Advanced Algebra (Doubleday) c) Crosswhite et al.: Pre Calculus Mathematics (Merrill) d) Dolciani: Modern Algebra and Trigonometry, Book 2 (Nelson)
Geometry 12	XII	*Graening and Nibbelink: Geometry British Columbia Metric Edition (1978) (Merrill)[1]
Probability and Statistics 12	XII	Willoughby: Probability and Statistics (GLC Canada)

[1] Unrevised Teachers' Edition available by purchase from Publication Services Branch.

APPENDIX

(2) Materials and Equipment **Years 1-8**

In the current program manipulative materials have assumed much greater emphasis than in the past. It is hoped that all students will experience the satisfaction of discovering mathematical relationships through manipulating concrete objects. The following have been identified as suitable aids in providing manipulative experiences.

A. Non-Metric

1. Multi-base Loop Abacus
2. Canadian Play Money
3. Plastic Counters
4. Cuisinaire rods
5. Geometric solids and dissectible cones, spheres
6. Geometric plane shapes (metric dimensions preferred)
7. Geoboards
8. Mathematical balance
9. Tangram playfits and Tangram Puzzles Book
10. Fraction playfits
11. Coffee Stir Sticks
12. Shotgun wads
13. Stop watch
14. Mirror Cards (Elementary Science Study) (McGraw-Hill)
15. Fraction Dominoes
16. Pattern Blocks and Mirrors (Setsco)
17. Geocards — Geoboard Activity Cards (Houghton Mifflin)
18. Project Math Activity Kit (Holt, Rinehart & Winston)
19. Sydney Cylinder Primary Math Lab (Scholar's Choice,
    50 Ballantyne Ave.,
    Stratford, Ontario)
20. Orbit Material for Mathematics (Book Society of Canada,
    Box 200,
    Agincourt, Ontario)
21. Individualized Math Lab (Random House/Singer,
    c/o Peter Clark,
    15772 Goggs Avenue,
    White Rock, B.C.)
22. Teaching Aids For Modern Mathematics (Holt, Rinehart & Winston)
23. Math Skills Kit (Van Nostrand Reinhold)

B. Metric Measurement Equipment

1. Blackboard metre stick
2. Metre stick (cm and mm)
3. Metric tapes
   150 cm (cm and mm)
   10 m (fibre glass)
   30 m (fibre glass)
   50 m (fibre glass)
4. Metric trundle wheel
5. Micrometre
6. Large Vernier Caliper
7. SI 30 cm rule (cm and m)
8. Primary 30 cm rule (cm only)
9. Metric graph paper (pkg/200)
10. Centimetre Base Ten Set
11. Centicubes (pkg/1000)
12. Centicube Teacher's Guide
13. Metric bathroom scale — 125 kg
14. Elementary School Balance (OHAUS or equal)
15. Bucket and Pan Balance
16. Beam Balance
17. Metric Pan Balance — 2 kg
18. Sets of Standard masses
    i) Stacking Plastic Mass Set (5 × 20 g, 10 × 10 g, 20 × 5 g)
    ii) Cast iron Mass Set (1 kg largest mass)
    iii) Primary masses (plastic) (10 × 10 g, 10 × 5 g)
19. Spring Balances (250 g, 500 g, 2000 g, 3 kg, 6 kg, 10 kg)
20. Litre measuring jug
21. Polyethylene Pails (graduated internally in litres)
22. Graduated Beaker Set (10 ml to 1000 ml)
23. Graduated Cylinders (clear plastic) 25 ml to 500 ml
24. Open cube (10 cm × cm) (clear or translucent plastic)
25. Demonstration thermometer (large) −5°C to +30°C
26. Metal-Backed thermometer −30°C to +110°C
27. Wall thermometer −30°C to +50°C
28. Dipping thermometer −10°C to +110°C
29. Clinical Thermometer
30. Pin boards (geoboards) 6 × 6 at 2 cm spacing — clear
    (square lattice) 11 × 11 at 2 cm spacing — plastic
31. Circular pin board — 1 cm grid — clear plastic
    (24 pins)

APPENDIX

(3) Supplementary and Reference Materials **Years 1 - 8**

THE ARITHMETIC TEACHER: THE MATHEMATICS TEACHER
Subscription price includes membership in the Council.

Very worthwhile journals published monthly 8 times a year, October through May, by the National Council of Teachers of Mathematics.

NOTES ON MATHEMATICS IN PRIMARY SCHOOLS
Members of the Association of Teachers of Mathematics
(Cambridge University Press)
Full of excellent ideas. (Grades K-6)

MATHEMATICS IN PRIMARY SCHOOLS
Curriculum Bulletin No. 1, The Schools Council
(Write SEE for latest catalogue or order from Her Majesty's Stationery Office).

The scope of this English bulletin is wide, as it aims not only at presenting the philosophy of the changes to which reference is made, but also at providing material help for teachers in their own classrooms, and particularly for teachers with large classes in small classrooms. It contains a great deal of helpful material for our elementary teachers. One of the most valuable books available. (K-6)

FREEDOM TO LEARN – AN ACTIVE LEARNING APPROACH TO MATHEMATICS
E.E. Biggs and J.R. MacLean (Addison-Wesley Canada Ltd.)

I DO AND I UNDERSTAND
(John Wiley & Sons)

PICTORIAL REPRESENTATIONS
(John Wiley & Sons)

Two excellent Nuffield Foundation Mathematics Project publications. The former is a guide for teachers and deals with the practical problems of classroom management encountered when children are set free in the classroom to make their own discoveries with concrete materials. The latter is designed to help teachers develop the pupil's ability to use graphs of various kinds. (K-6)

A number of other publications are available from the same source.

WORKJOBS
Mary Baratta Lorton (Addison-Wesley Canada Ltd.)

TEACHING AIDS FOR MODERN MATHEMATICS
Paper, (Holt, Rinehart & Winston)

A source book of ideas for elementary school teachers. Contains items that are inexpensive and easy to make, with directions for their construction and use and suggestions for possible variations. (K-6)

Supportive materials are available for all prescribed math texts. Consult the catalogues for supportive materials – transparencies, duplicator masters, test, workbooks, etc.

INDIVIDUALIZING MATHEMATICS
(Addison-Wesley) 1970
Skills and Patterns
Patterns and Discovery
Discovery and Structure

ARITHMETIC: A MODERN APPROACH
Keedy, Bittinger
(Addison-Wesley) 1971

ACTIVITIES IN MATHEMATICS
Course I and II
Johnson, et al. (Scott Foresman) 1973

CO-BASAL MATH KITS LEVEL 1 - 6
Kelly
(Encyclopedia Britannica Publications)

GEOBOARD GEOMETRY
(Farrell, Creative Publications) 1971
Distributed by: Setsco Educational Ltd.
1315 West 71 Avenue, Vancouver, B.C.

GEOBOARD ACTIVITY SHEETS
Cech, Tate
(Ideal School Supply Co.) 1970

AFTERMATH SERIES, BOOKS 1 - 4
Seymour, et al.
(Creative Publications) 1970
Distributed by: Setsco Educational Ltd.

MATH IS/1
Ebos, et al.
(Nelson) 1975

MATH IS/2
Ebos, et al.
(Nelson) 1975

MATHSENSE
Ailles
(Ginn) 1973

METRIC MEASUREMENT
Cortese, Herer
(American Book Co.) 1970

THINK METRIC!
Branley
(T.Y. Crowell Co.) 1972

MATH SKILLS KIT II a, b, c, d
McCormick – Mathers Publication Company

SYDNEY CYLINDERS MATHLAB METRIC
Scholar's Choice Ltd.

PEDAGOGICAL IMPLICATIONS OF METRICATION
(Council of Ministers of Education)

METRIC STYLE GUIDE
(Council of Ministers of Education of Canada)

ELEMENTARY SCHOOL MATHEMATICS
Activities and Materials – George F. Green Jr.
(D.C. Heath & Co.)

MATHEMATICAL UNITS – INTRODUCING STATISTICS
E.E. Shuker
(Evans Bros Ltd., London) 1970

PREPARING TO USE ALGEBRA
Shulte, Peterson
(Laidlaw Publishing Co., Doubleday Canada Ltd.) 1975

TANGLETABLE MATH
(Creative Publications)
Distributed by: Setsco Educational Ltd.

TANGRAMATH
(Creative Publications)
Distributed by: Setsco Educational Ltd.

MATHIMAGINATION
(Creative Publications)
Distributed by: Setsco Educational Ltd.

Note: Creative Publications Inc. have approved Reproduction permission for classroom use.

MATHEMETRICS BOOKS 1 - 5
(Book Society of Canada Ltd.)

HOLT. MATHS BOOKS 1 - 5
Holt, Michael
(Macmillan Company of Canada)

MATHWAYS YEARS 1 - 6
Bates et al.
(Copp Clark)

FIRST STEP IN GEOMETRY
G.R. Gibson
(Evans Brothers Limited, London)

GAMES FOR INDIVIDUALIZING MATHEMATICS LEARNING
L. Kennedy & R. Michon
(Charles Merrill Pub. Co.)

MATHACTION BOOKS 1 - 8
W.W. Bates et al.
(Copp Clark Publishing Co. 1970)

USING AND UNDERSTANDING THE METRIC SYSTEM
No. 69000 (SI Metric)
(McIntyre Educational Media Ltd.)

METRIC MAGIC
No. 6497 7M (SI Metric)
(McIntyre Educational Media Ltd.)

ADDITION AND SUBTRACTION WITH A HAPPY ENDING
Marcy & Marcy
(Creative Publications)

ACTIVITIES WITH GEOBLOCKS
Seymour
(Creative Publications)

CROSSNUMBER PUZZLE BOOK I
Hestwood, et al.
(Creative Publications)

NUMBER BLOX ACTIVITIES BOOK A AND B
Neufeld & Lucas
(Creative Publications)

PATTERN BLOCKS ACTIVITIES BOOK A AND B
Pasternack & Silvey
(Creative Publications)

PATTERN BLOCKS COLORING BOOK
Pasternack & Silvey
(Creative Publications)

FRACTIONS WITH PATTERN BLOCKS
Zullie
(Creative Publications)

The above Creative Publications Materials are distributed by:
Setsco Educational Ltd.
1315 West 71st Avenue
Vancouver, B.C.

FLIGHT INTO METRICS
(SI metric package)
Primary - 6
(Scholar's Choice)

bjs MATHGAMES
(SI metric)
Primary - 6
232-827 Addition and Subtraction
232-835 Multiplication and Division
232-843 Geometry

Scholar's Choice Limited
50 Ballantyne Ave.
Stratford, Ontario N5A 6T9

SRA MATHEMATICS LEARNING SYSTEM YEARS 1 - 6
(SI Metric)
Science Research Associates Ltd.
707 Gordon Road
Willowdale, Ontario M2H 2S6

GENERAL MATH I
Shaw, Wheatley, Kane, Schaefer
(Houghton Mifflin Canada Ltd.) 1977

APPENDIX

Years 9 - 10

ADVENTURES WITH ARITHMETIC
Swienciki, Lawrence N.

Book 1. Fractions
Book 2. Decimals
Book 3. Percent
Book 4. Algebra

Distributed by: Setsco Educational Ltd.
1315 West 71 Avenue, Vancouver, B.C.

ALGEBRA I
Dolciani, Wooton, Beckenbach
1974 (Houghton Mifflin Co.)

ALGEBRA I (teachers edition)
Vogeli, Prevost, Gilbert, Carroll
1971 (Silver Burdett Co. – General Learning Corporation)

– Flow charts and computers are included in each chapter to provide opportunities to integrate computer instruction with instruction in algebra.

ALGEBRA: A MODERN INTRODUCTION (instructor's manual)
Keedy, Bittinger
1973 (Addison-Wesley Publishing Co. Inc.)

– The instructor's manual suggests that the series of 12 booklets is intended for a course in elementary algebra over two years. Tests pertaining to the series include: Booklet tests; Pretests; Achievement Tests; Cumulative Tests.

Booklet 1: Whole Numbers; Addition and Subtraction
Booklet 2: Whole Numbers; Multiplication and Division
Booklet 3. Operations of the Numbers of Arithmetic
Booklet 4: Decimals and Percent
Booklet 5: Measures, Ratio and Averages
Booklet 6: The numbers of ordinary Arithmetic and Algebra
Booklet 7: Rational numbers; Algebra and Solving Equations
Booklet 8: Polynomials
Booklet 9: Functions and Basic Geometry
Booklet 10: Linear Equations and Systems of Equations
Booklet 11: Polynomials in Several Variables and Fractional Equations.
Booklet 12: Roots, Radicals, and Quadratic Equations

ALGEBRA: THE LANGUAGE OF MATHEMATICS (Teachers Edition)
Johnson and Johnson
1975 (Addison-Wesley)

APPLICATIONS IN MATHEMATICS: COURSE B
Johnson, Hansen, Peterson, Rudnick, Cleveland, Bolster
1974 (Scott, Foresman and Company)
– student activities in the lessons
– duplicating masters available for each unit

APPLIED MATHEMATICS TODAY: AN INTRODUCTION
D. Dottori, G. Knill, R. McVean, J. Seymour
1974 (McGraw-Hill-Ryerson)

BUSINESS AND CONSUMER MATHEMATICS
Saake, T.F.
(Duplicating masters available from Addison-Wesley)

CONSUMER MATHEMATICS
Francis G. Lankford, Jr. and William E. Goe
1971 (Harcourt Brace Dovanovich Inc.)

– Content is related to typical everyday consumer problems.

CONSUMER RELATED MATHEMATICS (Teachers Edition) SI Metric Ed.
Kravitz, Brant
1976 (Holt, Rinehart and Winston Inc.)

– Emphasizes computational skills, problems from the world of business and industry.

ELEMENTARY ALGEBRA Part 1
Denholm, Dolciani, Cunningham
1970 (Houghton Mifflin Co.)

ELEMENTARY ALGEBRA Part 2
Denholm, Dolciani
1971 (Houghton Mifflin Co.)

ESSENTIALS OF MATHEMATICS: SKILLS AND CONCEPTS, Book 4
Sobel, Maletsky
1973 (Ginn and Company)

FUNDAMENTALS OF MATHEMATICS
Stein
1971 Canadian Edition, (The Macmillan Company of Canada)
– Generally satisfies the objectives in the Mathematics Curriculum Guide.
– Includes exercises on review of computational skills

GEOMETRY IN MODULES 4 copies: a, b, c, d
Muriel Lange
1975 (Addison-Wesley)

HOLT ALGEBRA I

Nichols, Edwards, Garland,Hoffman, Mamary, Palmer
1974 (Holt, Rinehart and Winston Inc.)

– A good source for exercises

MATH IS/3

Ebos, et al.
(Nelson) 1975

MATH PROBE, 2 and 3

Bye, Elliot
1973 (Holt, Rinehart and Winston of Canada)

– Discovery exercises may be done in groups

MATH PROBE 4

Krysah, Bye, Elliot
1973 (Holt, Rinehart and Winston of Canada)

MATHEMATICAL PURSUITS ONE AND TWO, Teacher's Guides

Wygle et al.
(Macmillan)

MATHEMATICS FOR TODAY AND TOMORROW: METRIC EDITION

Dottori, Knill, McVean, Seymour
1974 (McGraw-Hill-Ryerson)

– Generally satisfies the objectives in the Mathematics Curriculum Guide.

MATHIMAGINATION

Steve and Janice March
(Distributed by Setsco Educational Ltd.)

– Workbooks designed to provide practice in basic mathematics skills
– Available in Teacher Edition for thermal reproduction

Book A: Beginning Multiplication
Book B: Operations With Whole Numbers
Book C: Number Theory, Sets, Number Bases
Book D: Fractions
Book E: Decimals and Percent
Book F: Geometry, Measurement, Cartesian Coordinates

MODERN ALGEBRA STRUCTURE AND METHOD, BOOK 1

Modules format, Dolciani et al., Set of Tests, Duplicating Masters, Program Practice, Teacher's Guide
(Houghton Mifflin)

MODERN BASIC GEOMETRY

Jurgenson, Maier, Donnelly
1973 (Houghton Mifflin Co.)

– Algebraic exercises are included in the textbook on geometry.

USING ALGEBRA
Travers, et al.
1975 (Laidlaw Publishing Co., Doubleday Canada Ltd.)

SUCCESS WITH MATHEMATICS (Teacher Edition and Student Edition)
Eicholz, Fleemor, O'Daffer, Ellis, Bittinger
1974 (Addison-Wesley Publishing Co.)

– The book provides opportunity to investigate mathematical ideas. The activity-oriented experiences may appeal to individual needs and interests.

TANGRAMATH
Dale Seymour
(Distributed by Setsco Educational Ltd.)

THE MATHEMATICS OF CONSUMER STUDIES
Canadian Edition, Teachers Edition

TROUBLE SHOOTING MATHEMATICS SKILLS, (Teacher's Edition)
Bernstein and Wells
(Holt, Rinehart and Winston)

– Magic Multiplier Materials Kit including duplicating masters.

LABORATORY EXPERIMENTS FOR ESSENTIALS OF MATHEMATICS 3
Sobel, Maletsky
(Ginn)

GRAPH GALLERY
Boyle
(Creative Publications)

MATHEMATICS CONTEST PROBLEMS
Brousseau
(Creative Publications)

CROSSNUMBER PUZZLE BOOK II
Hestwood, et al.
(Creative Publications)

PALATABLE PLOTTING
Boyle
(Creative Publications)

The above Creative Publications materials are distributed by:

Setsco Educational Ltd.
1315 West 71st Avenue
Vancouver, B.C.

BASIC ALGEBRA
Brown, Smith, Dolciani
(Houghton Mifflin Canada Ltd.) 197?

APPENDIX

Years 11-12

Algebra 11 and 12;

Dolciani et al.
ALGEBRA 2 AND TRIGONOMETRY, 2-14176, (Houghton Mifflin)

Nibbelink/Graening
ALGEBRA 2 WITH TRIGONOMETRY, (Merrill)

Smart, Holmes, Hood
ALGEBRA 2 WITH TRIGONOMETRY, (Ginn)

Moore
PRE-CALCULUS MATHEMATICS, (Wiley)

Sorgenfrey, Wooton, Dolciani
MODERN ALGEBRA AND TRIGONOMETRY, Book 2, (Houghton Mifflin)

Brown/Robbins
ADVANCED MATHEMATICS AN INTRODUCTORY COURSE, (Houghton Mifflin)

Devlin et al.
INTERMEDIATE ALGEBRA WITH TRIGONOMETRY, (Scott, Foresman)

Shanks, et al.
PRE-CALCULUS MATHEMATICS, 2nd edition, (Addison-Wesley)

Thomas
ELEMENTS OF CALCULUS AND ANALYTIC GEOMETRY, (Addison-Wesley)

Vance
MODERN ALGEBRA AND TRIGONOMETRY, 2nd edition, (Addison-Wesley)

Vance
MODERN ALGEBRA AND TRIGONOMETRY, 3rd edition, (Addison-Wesley)

Nichols, et al.
HOLT ALGEBRA 2 WITH TRIGONOMETRY, (Holt, Rinehart and Winston)

Vogeli, et al.
ALGEBRA 2 AND TRIG, (Silver, Burdett)

Serge Lang
BASIC MATHEMATICS, (Addison-Wesley)

Johnson, Lindsey, et al.
FUNDAMENTALS OF COLLEGE ALGEBRA, (Cummings)

Daniel M. Durbin
ELEMENTS OF PRE-CALCULUS MATHEMATICS, (Addison-Wesley)

Raoul L. Weinstein
PRE-CALCULUS MATHEMATICS: A FUNDAMENTAL APPROACH (Addison-Wesley)

Wooton, et al.
MODERN TRIGONOMETRY, (Houghton Mifflin)

Sorgenfrey, Wooton, Dolciani
MODERN ALGEBRA AND TRIGONOMETRY STRUCTURE AND METHOD, New edition, (Houghton Mifflin)

Wooton, et al.
MODERN TRIGONOMETRY, Revised edition, (Houghton Mifflin)

Dolciani, et al.
MODERN INTRODUCTORY ANALYSIS, (Houghton Mifflin)

Jacobs
MATHEMATICS: A HUMAN ENDEAVOR, (Freeman, San Francisco)

Keedy and Bittinger
ALGEBRA AND TRIGONOMETRY: A FUNCTIONS APPROACH, (Addison-Wesley)

Keedy and Bittinger
INTERMEDIATE ALGEBRA: A MODERN APPROACH, (Addison-Wesley)

Benice, D.D.
PRE-CALCULUS ALGEBRA AND TRIGONOMETRY, (Prentice-Hall)

CONSUMER MATHEMATICS 11

Bello
CONTEMPORARY BUSINESS MATHEMATICS, (W.B. Saunders)
a) Bello, et al.
Instructor's Manual for above
b) Workbook for above

Conchie
BUSINESS AND CONSUMER MATHEMATICS, (Addison-Wesley)
(Now part of Mathematics 10 program)

Printel and Diamond
BASIC BUSINESS MATHEMATICS, (Prentice-Hall)

Hummel and Seeback
MATHEMATICS OF FINANCE, 3rd edition, (McGraw-Hill)

Skeen, Wheeler, Johnson
MATHEMATICS WITH BUSINESS APPLICATIONS, (Addison-Wesley)

Ayres
MATHEMATICS OF FINANCE, (Schaum Publishing Co.)

Kravitz, Brant
CONSUMER RELATED MATHEMATICS — SI Metric Edition, 1976, (Holt, Rinehart, Winston)

Stelson
MATHEMATICS OF FINANCE, (Van Nostrand Reinhold)

Rosenburg, Sexton
BUSINESS MATH ON THE JOB, (A Practice Set), (McGraw-Hill)

Locke
CONSUMER MATH: A GUIDE TO STRETCHING YOUR DOLLAR, (Self Teaching), (Wiley and Sons)

Daw and Beatty
YOU, THE CONSUMER, 1974, (Wiley and Sons)

"Consumer Education Kit for Teachers"
B.C. Dept. of Consumer Services
838 Fort Street, Victoria, B.C. V8W 1H8

"Teaching Taxes Kit" (Available free annually)
Information Services Branch
Revenue Canada, Taxation
875 Heron Road, Ottawa, Ontario K1A 0L8

TRADES MATHEMATICS 11

Allyn J. Washington
BASIC TECHNICAL MATHEMATICS, (Cummings)

Allyn J. Washington
MODULES IN TECHNICAL MATHEMATICS, (Cummings)

1) Introductory Topics from Arithmetic
2) Introduction to Algebra
3) Introduction to Trigonometry

Dottori
TECHNICAL MATH EXERCISES, 1974, (McGraw-Hill Ryerson Ltd.)

a) Martin Clifford
Electrical Mathematics at Work
b) William W. Rogers and Paul L. Welton
Blueprint Reading at Work: Manufacturing
c) Paul L. Welton and William W. Rogers
Shop Mathematics at Work, 3rd edition
d) Martin Clifford
Drafting Mathematics
a-d) Available from General Learning Corporation
115 Nugget Avenue
Agincourt, Ontario
M1S 3B1

COMPUTING SCIENCE 11

BASIC

Coan
BASIC, BASIC, (Hayden)

Peluso, et al.
BASIC, BASIC: SELF-INSTRUCTIONAL MANUAL AND TEXT, (Hayden)

Dwyer and Kaufman
A GUIDED TOUR OF COMPUTER PROGRAMMING IN BASIC, (Houghton Mifflin)

Z.P. Jacobs, et al.
COMMUNICATING WITH THE COMPUTER, INTRODUCTORY EXPERIENCES, BASIC, 1975, (Allyn and Bacon)

Golden
COMPUTER PROGRAMMING IN THE BASIC LANGUAGE, 1975, (Harcourt, Brace, Jovanovich)

J. Petrak and J. Schellenberg
COMPUTER SCIENCE MODULES 1, 2, 3, 4, 1976, (Rand McNally)

Smith
DISCOVERING BASIC, (Hayden)

Smith
A VISUAL APPROACH TO BASIC, (CDC)

DeRossi
LEARNING BASIC FAST, 1975, (Reston)

S.L. Marateck
BASIC, 1975, (Academic Press)

FORTRAN

T. Walker
FUNDAMENTALS OF FORTRAN PROGRAMMING, 1975, (Allyn and Bacon)

Cress, Dirksen and Graham
FORTRAN IV WITH WATFOR AND WATFOR IV, 1970, (Prentice-Hall)

Healy and DeBrauzzi
BASIC FORTRAN IV PROGRAMMING, SELF-INSTRUCTIONAL MANUAL AND TEXT, 1968, (Addison-Wesley)

Z.P. Jacobs, et al.
COMMUNICATING WITH THE COMPUTER, INTRODUCTORY EXPERIENCES FORTRAN IV, 1973, (Allyn and Bacon)

PL/L

M. Davidson
PL/1 PROGRAMMING WITH PL/L, 1973, (Houghton Mifflin)

Bates and Douglas
PROGRAMMING PL/1, 1970, (Automatic Computation Services)

COMPUTERS AND SOCIETY

R.M. Baer
THE DIGITAL VILLAIN, 1972, (Addison-Wesley)

S. Rothman and C. Mosmann
COMPUTERS AND SOCIETY, 1972, (S.R.A.)

D.H. Sanders
COMPUTERS IN SOCIETY, 1973, (McGraw-Hill)

GEOMETRY 12

Nibbelink and Graening
GEOMETRY, B.C. METRIC EDITION (Ministry of Education) 1978, (Merrill)

Nibbelink and Graening
GEOMETRY – TEACHERS' EDITION (Unrevised) (Merrill)

Coxford, Usiskin
GEOMETRY, A TRANSFORMATIONAL APPROACH (Laidlaw)

Jurgensen, Maier, Donnelly
MODERN BASIC GEOMETRY (Houghton Mifflin)

Pearson and Smart
GEOMETRY (Ginn)

Jacobs
GEOMETRY (Freeman)
– A teacher's guide to Geometry

Ladd, Kelly
ELEMENTS OF GEOMETRY (Scott, Foresman)

Irving Adler
A NEW LOOK AT GEOMETRY (Signet Science Library Y3225)
– comes in pocket book form

C.R. Wylie, Jr.
FOUNDATIONS OF GEOMETRY (McGraw-Hill)

Moise and Downs
GEOMETRY (Addison-Wesley)

Gordon Fuller
ANALYTIC GEOMETRY, 4th edition (Addison-Wesley)

Eugene F. Krause
TAXI CAB GEOMETRY (Addison-Wesley)

Jurgensen, Donnelly, et al.
GEOMETRY, 1975 (Houghton Mifflin)

Jurgensen, Donnelly, Dolliam
MODERN SCHOOL MATHEMATICS GEOMETRY (Houghton Mifflin)
– also modules

Anderson, Garon, Gremillion
SCHOOL MATHEMATICS GEOMETRY (Houghton Mifflin)

MODERN COORDINATE GEOMETRY (A Wesleyen Experimental Curriculum Study)

Wooton, Bakenbach, Fleming
A MODERN ANALYTIC GEOMETRY (Houghton Mifflin)

PROBABILITY AND STATISTICS 12

Blakeslee, Chinn
INTRODUCTORY STATISTICS AND PROBABILITY (Houghton Mifflin)

Goodman and Ratti
FINITE MATHEMATICS WITH APPLICATIONS (Macmillan)

Benice
FINITE MATHEMATICS WITH ALGEBRA (Saunders)
– Instructor's Manual

Mizrahi/Sullivan
FINITE MATHEMATICS WITH APPLICATIONS (Wiley)

Mosteller, et al.
EXPLORING DATA, STATISTICS BY EXAMPLE (Addison-Wesley)
WEIGHING CHANCES
DETECTING PATTERNS
FINDING MODELS
– Teacher's Manual and Solution Key

Lipschutz
FINITE MATHEMATICS (Schaum Publishing Co.)

M.J. Moroney
FACTS FROM FIGURES (A Pelican Book)

Kaber and Rynyon
GENERAL STATISTICS, 2nd edition (Addison-Wesley)
– Teacher's Manual
Student Workbook

Mosteller, Rourke, Thomas
PROBABILITY WITH STATISTICAL APPLICATIONS, 2nd edition (Addison-Wesley)
– Teacher's Manual

Meserve
INTRODUCTION TO FINITE MATHEMATICS (Addison-Wesley)

Ingram
INTRODUCTORY STATISTICS (Cummings)

Mosteller, Rourke, Thomas
PROBABILITY A FIRST COURSE (Addison-Wesley)
—Instructor's Manual

Freund
MATHEMATICAL STATISTICS (Prentice-Hall)

Zuwaylif
GENERAL APPLIED STATISTICS (Addison-Wesley)

Malik and Mulklen
A FIRST COURSE IN PROBABILITY AND STATISTICS

Y.E. Bates
PROBABILITY (Addison-Wesley)

Morris H. De Groet
PROBABILITY AND STATISTICS (Addison-Wesley)

SETS, PROBABILITY AND STATISTICS – THE MATHEMATICS OF LIFE INSURANCE
The Canadian Life Assurance Assn.
44 King Street West
Toronto 1, Ontario

Stephen S. Willoughby
PROBABILITY AND STATISTICS (Silver-Burdett) (GLC, Canada)

Joan Gary Taylor, et al.
FINITE MATHEMATICS, 1973 (Harper and Row) (Fitzhenry and Whiteside)

Meyer
INTRODUCTORY PROBABILITY AND STATISTICAL APPLICATIONS
2nd edition (Addison-Wesley)

Wisner
ELEMENTS OF AVAILABILITY (Scott, Foresman)

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